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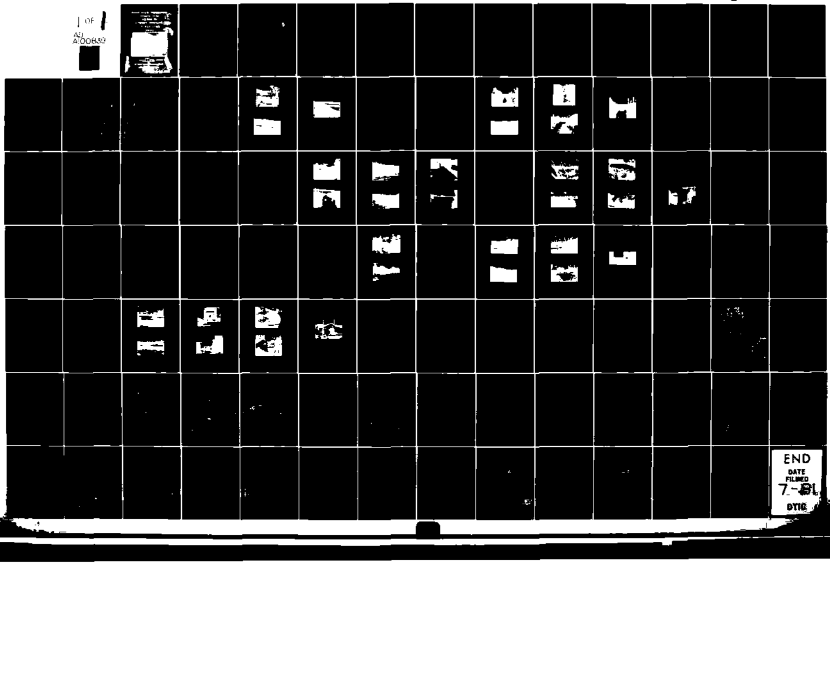

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This report is based on hydrological facts, histroical and recent flood heights and technical data having a bearing on the occurrence and magnitude of floods within the study area The objective of this report is to provide data that can be used as a guide by planners and local officials for effective and workable leguslation in control of land use within the flood plian. Maps, profiles, photogtaphs, and valley cross sections are included in this report.

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The cover photograph was taken by John Sager, Cuyahoga Falls, Ohio

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INTRODUCTION

This flood plain information report on the Cuyahoga River from Akron-Peninsula Road to the Summit-Portage County Line has been prepared at the request of the Ohio Department of Natural Resources and the Tri-County Regional Planning Commission. It will be distributed to local interests through the above agencies.

The objective of this report is to provide data that can be used as a guide by planners and local officials for effective and workable legislation in the control of land use within the flood plain. This report includes technical information on the largest known floods of the past and presents data on possible future floods, such as, the Intermediate Regional Flood and the Standard Project Flood. The Intermediate Regional Flood has a frequency of occurrence in the order of once in 100 years. Over a long period or 500 years, the magnitude of this flood would probably be equalled or exceeded five times, or on the average of once every 100 years. A flood of this magnitude is simply defined as having a one percent chance of being equalled or exceeded in any given year. On most streams in Ohio the Standard Project Flood is a flood of very rare occurrence and is larger than any flood that has occurred in the past. The area referred to as a flood plain in this report is the area that would be inundated by the Standard Project Flood. The frequency of occurrence of the Standard Project Flood is more rare than once in 500 years. When valuable development is planned within the flood plain, the levels of possible future floods, including the Standard Project Flood, should be considered.

This report is based on hydrological facts, historical and recent floods heights, and technical data having a bearing on the occurrence and magnitude of floods within the study area.

Maps, profiles, photographs, and valley cross sections are included in this report. From the maps, profiles, and cross sections the depth of probable flooding at any location from a recurrence of one of the past floods or by the future occurrence of either the Intermediate Regional

Flood or the Standard Project Flood may be determined. If properly used these data can be very beneficial in wise flood plain management. From this information, future construction should be planned high enough to avoid flood damages. If new construction must be placed at lower elevations, the chances and hazards of flooding should be recognized. Both the risks involved and available alternatives should be considered.

This report does not include plans for the solution of flood problems. However, it is intended to provide the basis for further study and planning on the part of local governments within the study area. Future flood damages can be reduced by local planning programs which guide and control essential developments in the flood plain through zoning, building codes, health regulations and other regulatory methods. Another means in which local flood plain management can be accomplished is through the public acquisition of land for a low flood damage use such as recreation.

Pamphlets and guides pertaining to flood plain regulations, flood proofing of structures, and other related actions have been prepared by the Corps of Engineers and are made available to State agencies, local governments and citizens in planning who are taking action to reduce potential flood damage.

The Buffalo District of the Corps of Engineers will provide technical assistance to Federal, State and local agencies in the interpretation and use of the information contained within this report. Information such as high water mark elevations, bench marks, and sample flood plain regulations is available. Requests for technical assistance should be coordinated through the Ohio Department of Natural Resources, Division of Water, 815 Ohio Departments Building, 65 South Front Street, Columbus, Ohio 43215.

SUMMARY OF FLOOD SITUATION

This flood plain information study covers the area along the Cuyahoga River from the Akron-Peninsula Road bridge, stream mile 40.25, to the Summit-Portage County Line, stream mile 52.65. Within the 12.4-mile study area the Cuyahoga River flows through the cities of Akron, Cuyahoga Falls, and Stow and the villages of Silver Lake and Munroe Falls.

All of these communities are in Summit County and their locations are shown on plate 1. The study area is approximately 30 miles south of Cleveland.

Presently there are eight U. S. Geological Survey water-stage recording stations in the Cuyahoga River basin. The locations of these gaging stations are shown on plate 1. The closest gaging station to the study area is at Old Portage located 230 feet upstream of the Akron-Peninsula Road bridge about four miles northwest of Akron. This station measures the flow from a drainage area of 404 square miles. Records published by the United States Geological Survey are available for this station from September 1921 to December 1935 and from March 1939 to the present.

Local government officials and property owners adjacent to Cuyahoga River have been interviewed, and newspaper files and historical documents have been searched for information concerning past floods. From these data and studies of possible future floods on the Cuyahoga River, both the past and future flood situation has been developed.

HISTORICAL FLOOD - Historical documents show that there was severe flooding March 1913 and on 28 June 1924. An estimated stage of 12.0 feet at the Old Portage gage occurred in March 1913. On 28 June 1924 the stage at the gage reached 10.0 feet.

THE GREATEST FLOOD - The greatest known flood recorded on the Cuyahoga River at the Old Portage gage occurred on 21 January 1959. Based on existing development, its peak flow at the Old Portage gage has a frequency of occurrence in the order of once in 200 years.

OTHER GREAT FLOODS - High water and damage in the study area have also occurred on the following dates: 10 February 1959, 26 January 1952, 16 November 1955, and 8 July 1957.

INTERMEDIATE REGIONAL FLOOD - The Intermediate Regional Flood is a flood that has an average frequency of occurrence in the order of once in 100 years. As shown on plates 8 through 10, the January 1959 flood averages 0.6 foot higher than the Intermediate Regional Flood in the area downstream of the confluence of the Little Cuyahoga River. Upstream of Cuyahoga Falls, the Intermediate Regional Flood averages one foot higher than the January 1959 flood. Peak discharges during an Intermediate Regional Flood on the Cuyahoga River are estimated as 5,820 cfs at the Old Portage gage and 5,300 cfs upstream of the confluence of Little Cuyahoga River. Table I compares the Intermediate Regional and Standard Project Floods with the January 1959 floods at selected locations in the study area.

STANDARD PROJECT FLOOD - The Standard Project Flood is a flood resulting from a severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the drainage basin under study. The Standard Project Flood is not assigned a frequency although it is more rare than once in 500 years. Its water surface is considered by the Corps of Engineers to be the upper limit of the flood plain. Estimated Standard Project Flood discharges and stages at selected locations are listed on table I.

FLOOD DAMAGES - The recurrence of major known floods such as the 1913, 1952, and 1959 floods would result in substantial damage in the study area. An occurrence of the Standard Project Flood would cause extensive damage within the flood plain because of greater depths of flooding and accompanying higher velocities.

MAIN FLOOD SEASON - The greatest floods of record in the Cuyahoga River basin occurred in March 1913, June 1924, January 1952, November 1955, and January 1959. Flooding can occur in any month of the year. Flooding

TABLE I

RELATIVE FLOOD HEIGHTS ON THE CUYAHOGA RIVER

Location	Mile Above Mouth	Flood	Estimated Peak Discharge (cfs)	Above or below Jan. 1959 Flood (feet)
Akron-Peninsula Rd. bridge (Downstream limit of study)	40.25	January 1959	6,500	--
		Intermediate Regional	5,820	- 0.7
		Standard Project	41,100	+ 10.9
Cuyahoga St. bridge	42.77	January 1959	4,400	--
		Intermediate Regional	5,300	+ 0.4
		Standard Project	35,400	+ 14.0
Broad Blvd. bridge	46.37	January 1959	4,400	--
		Intermediate Regional	5,300	+ 1.0
		Standard Project	35,400	+ 24.0
Summit-Portage County Line (Upstream limit of study)	52.65	January 1959	4,400	--
		Intermediate Regional	5,300	+ 0.6
		Standard Project	32,500	+ 14.8

during the winter and spring months is normally the result of melting snow accompanied by moderate amounts of rainfall. Intense local thunderstorms during the summer and fall can also produce flooding.

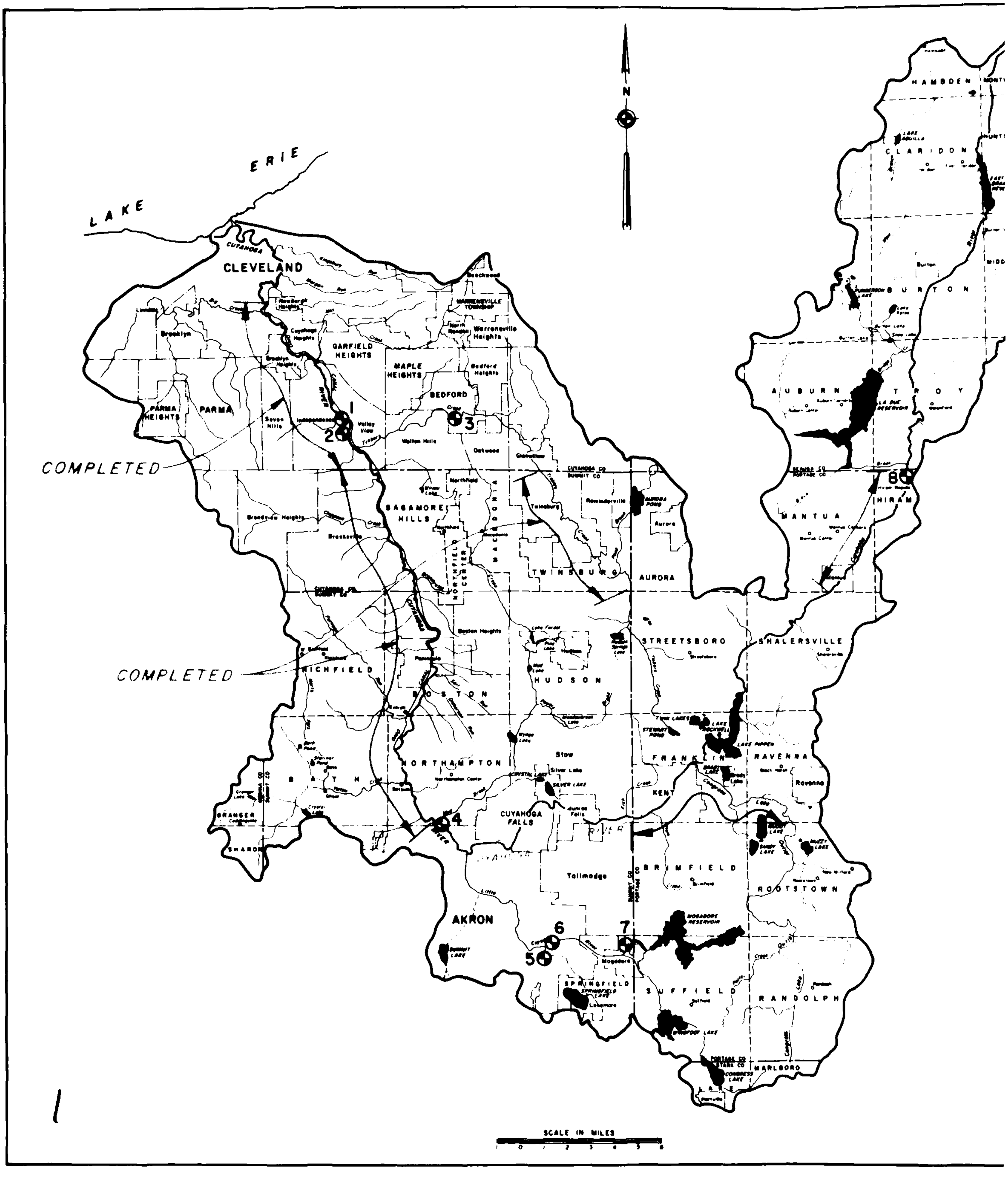
FLOOD DAMAGE PREVENTION MEASURES - In March 1964 the Corps of Engineers submitted an unfavorable reconnaissance report for flood control on the Cuyahoga River in the vicinity of Cuyahoga Falls, Silver Lake and Munroe Falls under provisions of Section 205 of the 1962 Flood Control Act. Figure 1 is an example of a flood damage prevention measure. The River and Harbor Act of 1970 authorized a program to investigate and undertake measures in the interests of water and environmental quality, recreation, and flood control for the Cuyahoga River Basin. Its purpose is to restore the Cuyahoga River and its tributaries.

Runoff from the upper Cuyahoga River basin is modified by four reservoirs. These reservoirs, shown on plate 1, serve dual purposes: domestic and industrial water supply and flood control. They have been partially financed with Federal funds. The four reservoirs are described below:

(a) Mogadore Reservoir - controls 12 square miles of the head waters of Little Cuyahoga River and was constructed by the Works Project Administration and the City of Akron. The Federal share of total costs was $900,000. The reservoir supplies raw water to industries in Akron via the channel of the Little Cuyahoga River. (See figure 2).

(b) East Branch Reservoir - is located north of Burton on the Cuyahoga River and regulates river flow to Lake Rockwell Reservoir, the principal water supply reservoir of the City of Akron. The federal share of total costs was $258,000. The reservoir impounds about 4,600 acre-feet of water and subtends a drainage area of about 18 square miles.

(c) Lake Rockwell Reservoir - is located on the Cuyahoga River about two miles northeast of Kent and was constructed by


LAKE ERIE
CLEVELAND
COMPLETED
COMPLETED
GARFIELD HEIGHTS
MAPLE HEIGHTS
BEDFORD
PARMA HEIGHTS
PARMA
SAGAMORE HILLS
TWINSBURG
AURORA
STREETSBORO
SHALERSVILLE
RICHFIELD
HUDSON
BOSTON
NORTHAMPTON
FRANKLIN
RAVENNA
KENT
CUYAHOGA FALLS
BRIMFIELD
ROOTSTOWN
AKRON
SPRINGFIELD
SUFFIELD
RANDOLPH
MARLBORO
HAMBDEN
CLARIDON
BURTON
AUBURN
TROY
MANTUA
HIRAM
GRANGER
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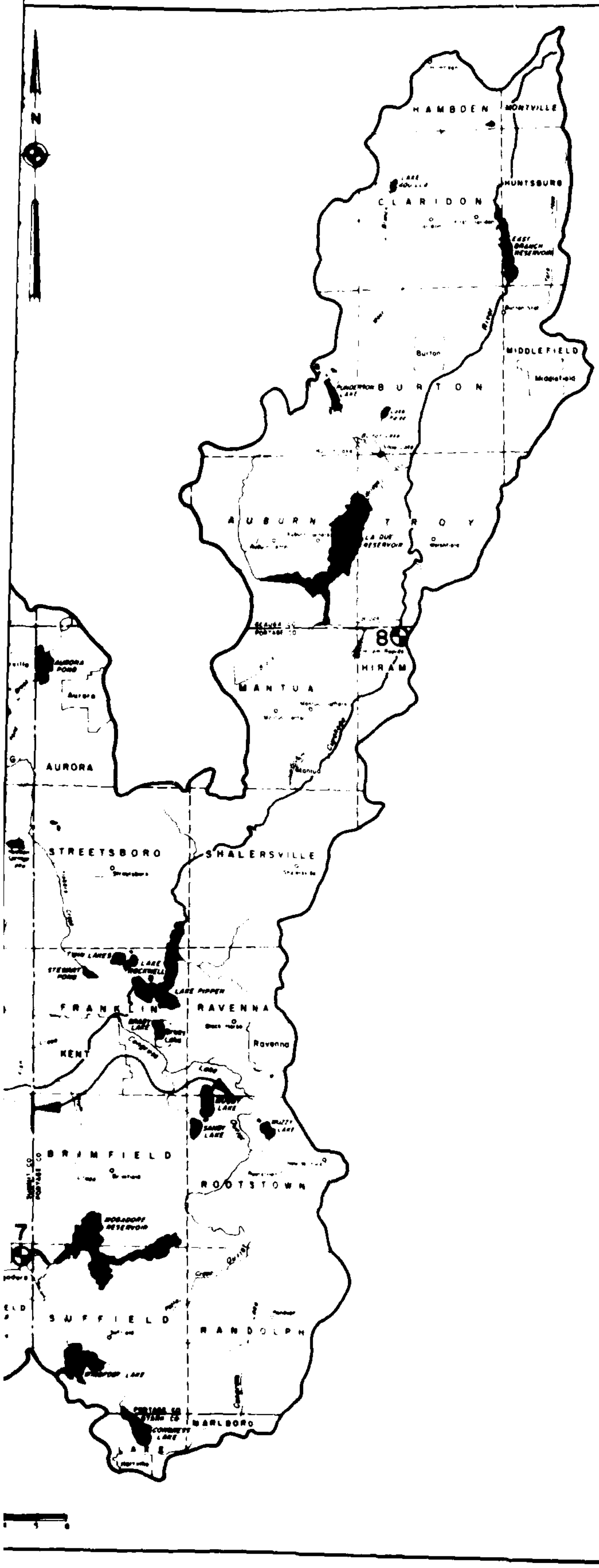
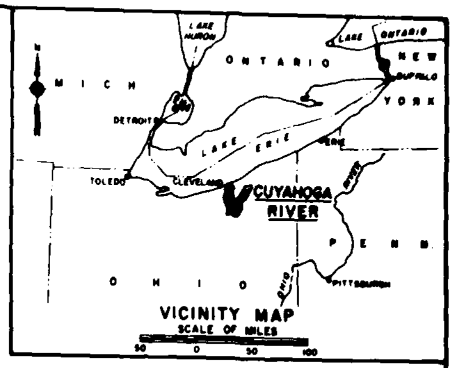




LEGEND:

BLUE LINE INDICATES REACH COVERED BY THIS STUDY

OTHER AUTHORIZED FLOOD PLAIN INFORMATION STUDIES WITHIN THE CUYAHOGA RIVER BASIN

U.S.G.S. WATER-STAGE RECORDING GAGE

1 CUYAHOGA RIVER AT INDEPENDENCE

2 OHIO CANAL AT INDEPENDENCE

3 TINKERS CREEK AT BEDFORD

4 CUYAHOGA RIVER AT OLD PORTAGE

5 SPRINGFIELD LAKE OUTLET AT AKRON

6 LITTLE CUYAHOGA RIVER AT MASSILLON ROAD, AKRON

7 LITTLE CUYAHOGA RIVER AT MOGADORE

8 CUYAHOGA RIVER AT HIRAM RAPIDS

2

CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

BASIN MAP

U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE I

the City of Akron for water supply. It controls about 205 square miles of drainage area and has a considerable modifying effect on floods in the upper basin.

(d) LaDue Reservoir - is located just north of Hiram Rapids and controls about 30 square miles of drainage area. This reservoir was also constructed by the City of Akron for water supply. (See figure 3).

POSSIBLE FLOOD HEIGHTS - Flood levels that would be reached by the Intermediate Regional and Standard Project Floods are shown on table 1. The table compares these flood crests with the January 1959 flood at selected sites along the Cuyahoga River. The water surface profile for the January 1959 flood, the Intermediate Regional Flood, and the Standard Project Flood are shown on plates 8 through 10.

VELOCITIES OF WATER - Estimated average channel velocities on the Cuyahoga River during a major flood occurrence such as the January 1959 flood vary from approximately two to five feet per second in the mildly sloping sections of the river to approximately 14 feet per second in the narrow, steep sloped section in Cuyahoga Falls. Velocities in the overbank areas average 1.5 feet per second. Velocities greater than 3 feet per second combined with flow depths of 3 feet or greater are generally considered hazardous.

HAZARDOUS CONDITIONS - Past floods have caused numerous hazards to local residents. Since many of the past floods have occurred in late winter or early spring, residents may suffer illness and discomfort from lack of heat for a number of days if basement flooding extinguishes furnace fires. In a flood, health problems frequently develop when septic tanks and municipal sewage treatment facilities are taxed beyond their capabilities. Flood waters overtop roads and cause hazardous driving conditions. The amount of damage caused by any flood depends upon the type and extent of development, how much area is flooded, the depth of flooding, the duration of flooding, and the velocity of flow.

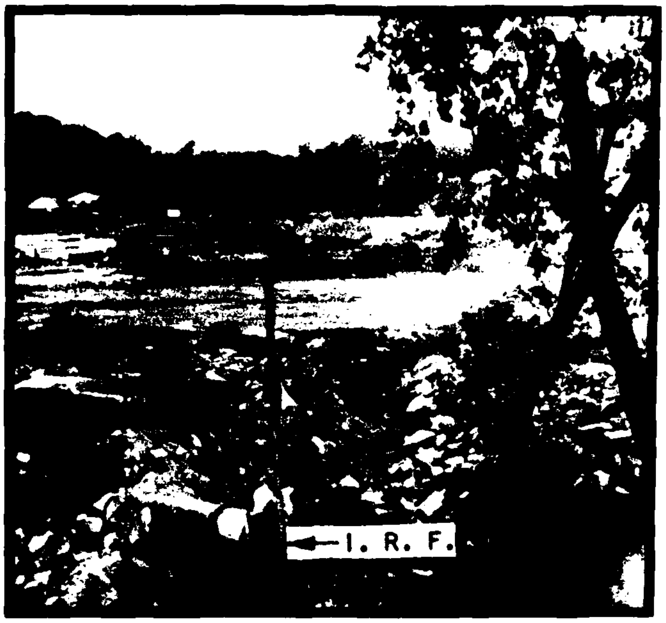


Figure 1 - Flap gate prevents high water from backing up pipe, stream mile 40.3. Arrow indicates height of Intermediate Regional Flood.

Photograph was taken in May 1970.

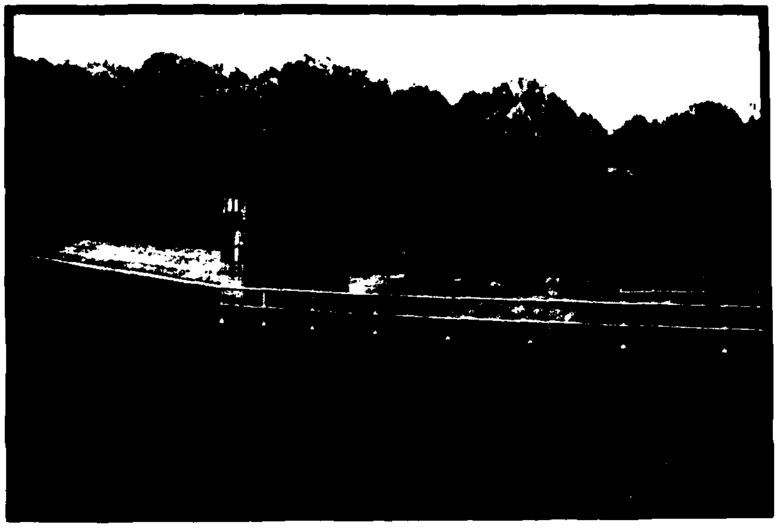


Figure 2 - Upstream face of dam at Mogadore Reservoir in Portage County.

Flood damage prevention measures
Photograph was taken in October 1962.

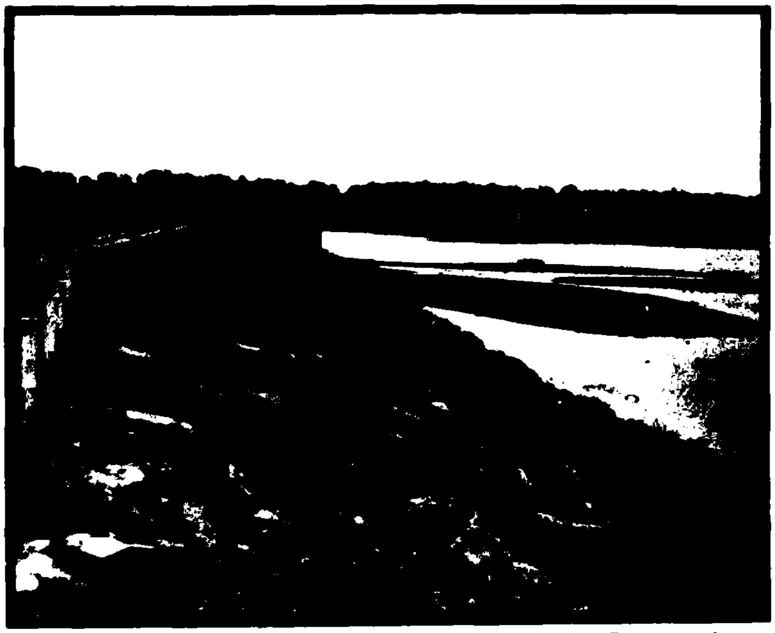


Figure 3 - Upstream face of dam at LaDue Reservoir in Geauga County.

Flood damage prevention measure
Photograph was taken in October 1962.

GENERAL CONDITIONS AND PAST FLOODS

GENERAL - This section of the report is a history of past floods on the Cuyahoga River from Akron to the Summit-Portage County Line. The study area extends upstream approximately 12 miles from the Akron-Peninsula Road bridge.

THE STREAM AND ITS VALLEY - The Cuyahoga River drains a "U" shaped basin approximately 809 square miles in northeastern Ohio. The basin shown on plate 1 includes parts of Cuyahoga, Geauga, Medina, Portage, Stark and Summit Counties. The river rises about ten miles northeast of Burton, Geauga County, and flows in a southerly direction to near the village of Hiram Rapids, then southwesterly and westerly, passing through Mantua, Kent, and Cuyahoga Falls to its the confluence with the Little Cuyahoga River at Akron, thence northerly to Lake Erie at Cleveland. The total drainage area upstream of the U.S.G.S. gage at Old Portage is 404 square miles, or about 50% of the total Cuyahoga River drainage area. The main tributaries of the river are: Big, Mill, Tinkers, Yellow, Brandywine, and Chippewa Creeks, Mud Brook, Furnace Run, Little Cuyahoga River, Breakneck Creek (Congress Lake Outlet) and West Branch Cuyahoga River.

The watershed consists of rolling hills except for the gently sloping area about three miles wide bordering Lake Erie. The Cuyahoga River rises at about elevation 1,300 feet above mean sea level and discharges into Lake Erie at about elevation 570.0. Upstream of Cuyahoga Falls, the Cuyahoga River cuts through glacial drift and is relatively flat with a fall of about four feet per mile. At Cuyahoga Falls the river cuts through Pennsylvania sandstone and drops 220 feet in 1.5 miles. In the lower northward course, the river flows in a pre-glacial valley with a fall of about five feet per mile. In the reach between the mouth of Tinkers Creek and the head of navigation in Cleveland, the channel falls 25 feet in 10 miles. Most of the residential, commercial, and industrial development in the study area is located on ground lying above the flood plain. Various channel conditions in the study area are shown on figures 4 through 8. Table 2 shows various drainage areas within the Cuyahoga River basin.

STREAM GAGING RECORDS - Presently there are eight gaging stations in the Cuyahoga River basin maintained by the U.S. Geological Survey. The Cuyahoga River gage at Old Portage is the only one in the reach covered by this report. The Old Portage gage is located just upstream of the Akron-Peninsula Road bridge about four miles northwest of Akron. The total drainage area upstream of the gage site is 404 square miles. The first record of stages and discharges on Cuyahoga River at Old Portage began in September 1921. Annual reports published by the United States Geological Survey furnish the average daily discharges in cubic feet per second, the maximum and minimum instantaneous discharges, and the maximum and minimum water stages. An annual publication "Water Resources for Ohio, Part I" is available from the U.S. Geological Survey office in Columbus, Ohio. In recent years, several of the continuous water-stage recorders that produce a graphic representation of the rise and fall of the water surface with respect to time have been replaced by digital-type recorders. A digital-type recorder punches onto a paper tape the stage at a selected time interval permitting the direct computerization of stream flow data. The time interval at which the stage is punched onto the tape is selected such that a stage hydrograph (See Glossary) can be adequately defined. The U.S. Geological Survey also maintains staff gages. A staff gage, a graduated scale anchored vertically on the stream bank, provides a visual determination of the water surface at any given time.

Figure 4 - Little Cuyahoga River, one of the major tributaries in study area.

Figure 5 - Looking downstream from atop the Akron-Cleveland Road bridge, stream mile 44.0.

Photographs were taken in December 1970.

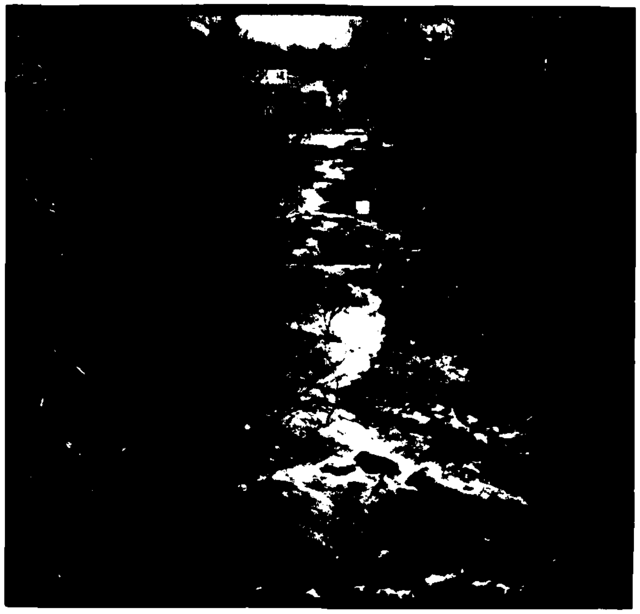


Figure 6 - Looking upstream along the Cuyahoga River in Cuyahoga Falls, stream mile 46.6.

Photograph was taken in April 1963.

Figure 7 - Fish Creek, a tributary in study area.

Photograph was taken in December 1970.

Figure 8 - Looking downstream along the Cuyahoga River, stream mile 52.7.

Photograph was taken in December 1970.

Pertinent drainage areas of the Cuyahoga River and its tributaries are given in table 2.

TABLE 2

DRAINAGE AREAS WITHIN THE CUYAHOGA RIVER BASIN

Location on Cuyahoga River	Mile Above Mouth	Drainage Area Upstream of Location (square miles)
Mouth	0.0	809
Big Creek junction	7.4	749
Mill Creek junction	11.8	710
Independence Gage	13.9	707
Tinkers Creek junction	17.3	597
Chippewa Creek junction	21.6	565
Brandywine Creek junction	24.7	528
Furnace Run junction	33.5	480
Yellow Creek junction	37.4	443
Mud Brook junction	39.9	433
Old Portage Gage	40.3	404
Little Cuyahoga River junction	42.4	340
Breakneck Creek junction	59.2	211
Hiram Rapids Gage	79.3	151
West Branch Cuyahoga River junction	88.6	41.4

SETTLEMENT

CITY OF AKRON - General Simon Perkins, "Father of Akron," came from Connecticut to explore the lands of the Western Reserve. In 1780 he settled in Warren, Ohio, and became an extensive land owner. In 1825, hearing a canal was to be built, he founded the town of Akron. The new town was largely in the hands of his son, Colonel Simon Perkins. After the Ohio Canal was completed in 1827, Akron became an important manufacturing center due to the availability of transportation on the canal. When Summit County was created in 1840, Akron was selected as its county seat. Early industry in Akron included stoneware, pottery plants, and cereal mills. The rubber industry transformed Akron into a booming industrial city in 1900. Today Akron is not only the world's rubber manufacturing center, but it also is one of the major centers of the trucking industry. Other areas of employment include plastics, missile, and aerospace. In 1970 the population of Akron was greater than 270,000.

CITY OF CUYAHOGA FALLS - Originally the land in Cuyahoga Falls had two owners, Joshua Stow and Roger Newberry of Connecticut. In 1804 a company of emigrants started from Middletown, Connecticut for Ohio after making arrangements with Joshua Stow for settlement upon his land. William Wetmore was among those that came. Cuyahoga Falls was first called Manchester. When it was discovered that there were several Manchesters in Ohio, it was decided to name the settlement Cuyahoga Falls. Located on the Cuyahoga River at a point where the river plunges downward 240 feet through a gorge, Cuyahoga Falls was always blessed with an abundance of water power. In 1825 William Wetmore built a dam. Using the power from this dam, a mill was opened for lumber, grain, and linseed oil and established the first major industry in Cuyahoga Falls. By 1837 three dams were converting the force of the Cuyahoga River into power, and Cuyahoga Falls became a promising manufacturing center in Northern Ohio. In April 1851 the Township of Cuyahoga Falls was chartered. The town was re-incorporated as a village of 1868. In 1920 Cuyahoga Falls became a city. Today's industries include rubber, food and dairy products, furniture, wood products and plastics.

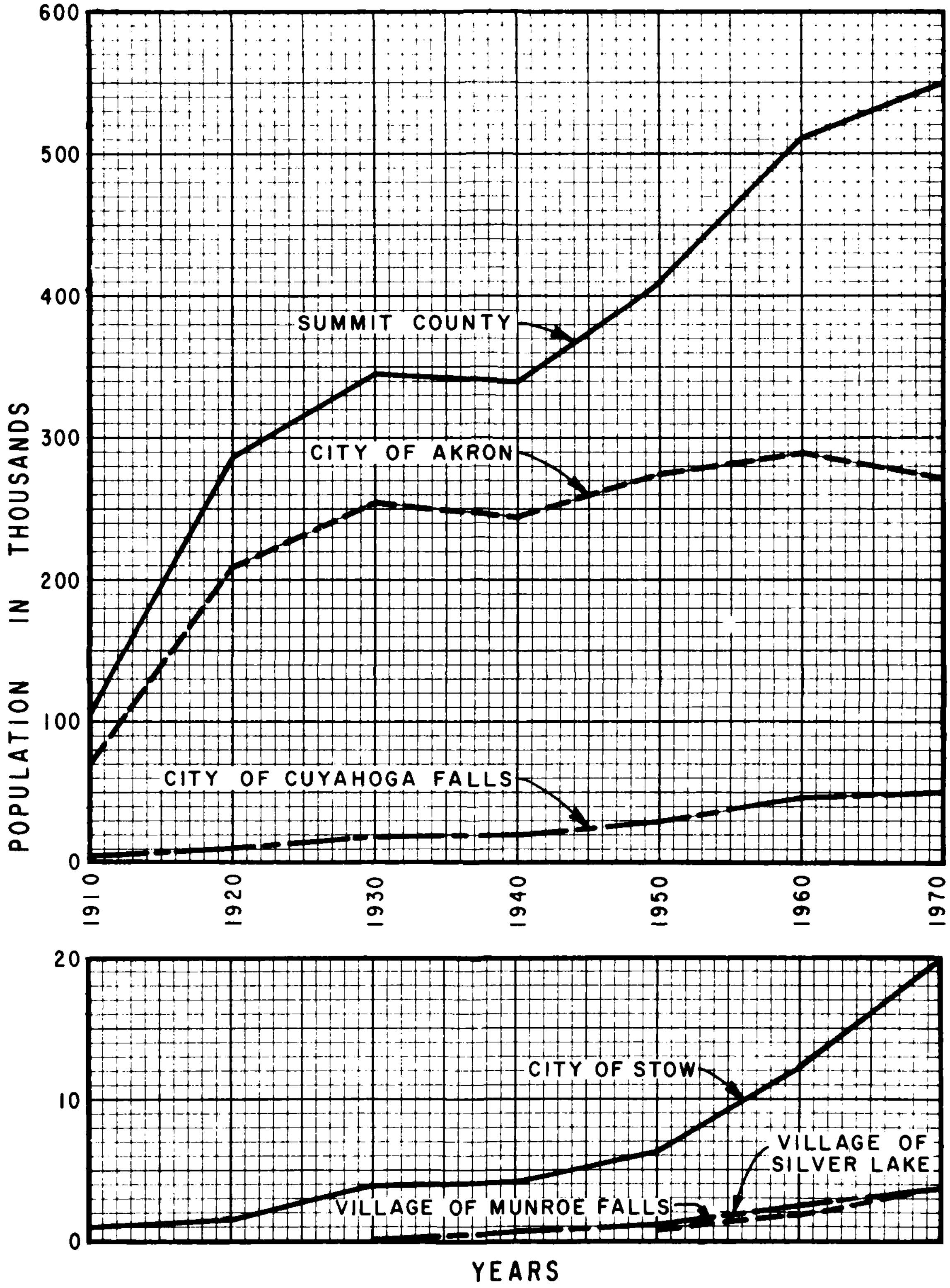
VILLAGE OF SILVER LAKE - Originally the Silver Lake area was part of the Western Reserve. In 1804 William Wetmore came to Silver Lake from Connecticut as a real estate agent for Joshua Stow, a purchaser of the township. Before he and his family founded the first white settlement, 500 Seneca Indians were already living there. Silver Lake Village was founded by William R. Lodge in 1917. A charter-type government was adopted in 1926. At one time Silver Lake was one of the leading amusement resorts in Northern Ohio. Its crystal water and natural setting was popular with thousands of people.

CITY OF STOW - Stow Township, originally a part of the Western Reserve, was sold by the Connecticut Land Company to Joshua Stow of Middletown, Connecticut. The first settler was William Walker, a Virginian, who built a home in the northeastern part of the township of 1802. Stow was founded by Joshua Stow and William Wetmore in 1804. Originally attached to Hudson Township for governmental purposes, Stow became a separate political entity in 1808. Part of the city of Cuyahoga Falls was originally in Stow Township.

VILLAGE OF MUNROE FALLS - In March 1836 a wealthy merchant from Boston Massachusetts, Edmund Munroe, founded the town of Munroe Falls. In 1837 the Munroe Falls Manufacturing Company was chartered to manufacture silk, wool, cotton, paper, and flour. Today Munroe Falls has a population of approximately 3,800.

POPULATION - Figure 9 illustrates the population trends for the individual communities in the study area. Since 1950 the population in the study area has increased 25 percent.

DEVELOPMENT IN FLOOD PLAIN - The location of the study area relative to the Cuyahoga River basin is shown on the basin map on plate 1. Although the study area is relatively undeveloped at the present time, population trends indicate that the area will become more developed in the future largely because of the expansion of the Akron metropolitan area. There are several commercial buildings located near the channel in Cuyahoga Falls. It is imperative that flood plain regulations be adopted now so that future development will not be on lands that have been flooded in the past or may flood in the future.



POPULATION TRENDS

FIGURE 9

EXISTING REGULATIONS - There are no flood plain regulations in the study area. However, flood plain regulations could control development within the flood plain while making the most effective use of land with respect to flood risk. Such regulations may be made possible by counties, municipalities, and townships under their regular zoning and building code statutes. Samples of flood plain regulations passed in communities throughout the country are available at the Buffalo District office.

This report provides local governments with information on which to base their regulations.

In the State of Ohio, the power to adopt and enforce zoning regulations is delegated to political subdivisions. The enabling statutes are sections 303.02, 519.02 and 713.07 of the revised code. The General Assembly of the State of Ohio has passed an amendment to House Bill No. 314 that states all department and agencies of the State shall notify and furnish information to the Division of Water on State facilities which may be affected by flooding. This information is required in order to avoid the uneconomical, hazardous, or unnecessary use of flood plains in connection with State facilities. The amendment further reads that where economically feasible, departments and agencies of the State and political subdivisions responsible for existing publicly owned facilities shall apply flood proofing measures in order to reduce potential flood damage. Under Executive Order 11296, the Federal Government has similar restrictions in that all executive agencies directly responsible for the construction of Federal facilities shall evaluate flood hazards when planning the location of new facilities. In addition, this order requires that executive agencies responsible for the administration of Federal grant, loan or mortgage insurance programs shall evaluate flood hazards in order to minimize potential flood damage and the need for future Federal expenditures for flood protection and flood disaster relief.

FLOOD WARNING AND FORECASTING SERVICES - The study area is well within the effective range of the Weather Surveillance Radar which is operated continuously by the National Weather Service at the Cleveland Airport and the Akron-Canton Airport. This equipment provides for the early detection and plotting of heavy precipitation and makes possible immediate radio and television broadcasts of information concerning the predicted path and amount of rainfall from the storm.

BRIDGES - There are 13 highway bridges, one foot bridge, and one railroad bridge in the reach covered by this study. Table 3 lists pertinent data for these structures and shows the relationship of the Intermediate Regional Flood and the Standard Project Flood to the January 1959 flood.

Water surface profiles shown on plates 8 through 10 should be helpful to local officials in any future construction of new bridges or alterations of existing bridges. At any new bridges there should be sufficient clearance for drift and debris which usually accompany high water. On figures 10 through 13 are photographs of some of the bridges.

DAMS - There are 4 dams on the Cuyahoga River in the study area. Pertinent data on these dams are shown on table 4. Figures 14 and 15 show two of these structures.

TABLE 3

BRIDGES IN STUDY AREA

Mile Above Mouth	Identification	Stream Bed Elev.	Floor Elev. (2)	Underclearance Low Steel Elev.	Jan. 1959 Flood Crest Elev. (1)	Intermediate Regional Flood Crest Elev. (1)	Standard Project Flood Crest Elev. (1)
40.25	Akron-Peninsula Rd.	737.3	759.6	755.2	751.6	750.9	762.5
41.84	Foot bridge	741.2	*	*	758.9	758.1	775.4
42.77	Cuyahoga Street	753.0	771.2	766.6	763.2	763.6	777.2
44.08	Akron-Cleveland Rd.	790.0	(4)	(4)	797.2	797.9	815.3
45.11	Ohio Rte. 5 (Southbound)	880.0	927.2	921.6	913.6	914.4	923.2
45.13	Ohio Rte. 5 (Northbound)	880.0	950.0	930.3	913.6	914.4	923.2
46.13	Prospect Ave.	921.0	1003.5	982.1	926.9	927.6	941.3
46.37	Broad Blvd.	966.8	1002.2	996.2	983.5	984.5	1007.5
46.58	Portage Trail	968.1	1031.0	1027.0	983.6	984.8	1008.1
46.82	Ohio Rte. 8 Freeway (5)						
47.35	Penn Central Trans. Co.	979.5	1015.3 (3)	1003.8	996.9	997.9	1017.3
47.38	Bailey Rd.	981.5	1003.0	999.0	997.1	998.1	1018.3
47.43	Hudson Drive	982.0	1020.5	1016.0	997.2	998.2	1018.5
47.72	Oak Park Blvd.	984.0	1011.1	1003.8	997.5	998.5	1019.5
49.96	Darrow Rd. (Ohio Rte. 91)	988.8	1008.3	1003.8	1000.1	1001.0	1020.6

* Information not available
(1) All elevations referred to upstream side of respective bridges
(2) All flood elevations are referred to centerline of street except where the top of rail is given
(3) Top of rail elevation
(4) High level bridge
(5) Under construction

TABLE 4

DAMS IN STUDY AREA

Location Mile Above Mouth	Upstream Channel Elev.	Spillway Crest Elev.	Spillway Length (feet)
44.71	870.0	908.0	119
46.34	966.0	975.1	65
46.63	976.0	990.1	102
50.09	993.0	1002.0	135

Elevations are on U.S.C. & G.S. Datum.

Figure 10 - Upstream face of the Akron-Peninsula Road bridge, stream mile 40.25.

Figure 11 - Upstream face of the new Portage Trail bridge, stream mile 46.58.

Typical bridges
Photographs were taken in December 1970.

Figure 12 - Upstream face of the Oak Park Boulevard bridge, stream mile 47.72.

Figure 13 - Upstream face of the Darrow Road bridge, stream mile 49.96.

Typical bridges
Photographs were taken in December 1970.

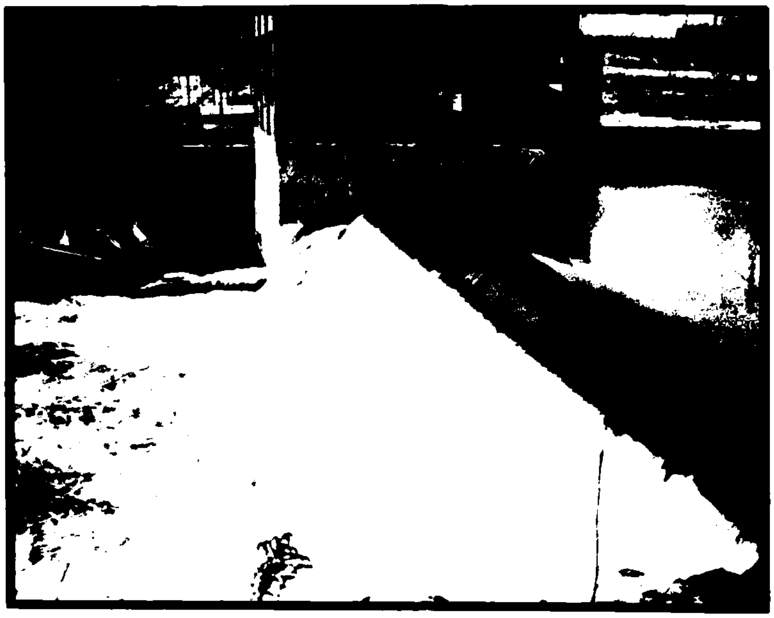


Figure 14 - Downstream face of dam in Cuyahoga Falls, stream mile 46.63.

Photograph was taken in December 1970.

Figure 15 - Downstream face of dam in Munroe Falls, stream mile 50.09.

Typical dams
Photograph was taken in April 1963.

OBSTRUCTIONS TO FLOOD FLOWS - Inadequate bridge areas, abandoned dams, encroachments, and fills are some of the obstructions to flood flows. Other serious obstructions are bends in the stream, irregularity of channel section, and heavy brush, weeds, and large trees growing on the channel banks and extending into the stream. Figures 16 through 19 show obstructions which tend to reduce floodway capacity and increase river stages.

To keep obstructions to flows at a minimum, each community should establish maintenance programs for streams within their area. For example, highway crews during slack periods could remove fallen trees, shoals, and debris that may have collected in the channel. A concentrated effort should be made by the people not to throw refuse or other matter into the streams. The local government should establish a floodway, a strip of land on either side of the river that is kept free of obstructions to flows. Flood flows have come in the past and they will come again. A floodway provides extra room when high water comes.

Figure 16 - Dumping along right bank downstream of the Akron-Peninsula Road bridge, stream mile 40.2.

Figure 17 - Debris at bridge on Little Cuyahoga River.

Obstructions to flood flows
Photographs were taken in December 1970.

Figure 18 - Debris in river upstream of dam in Cuyahoga Falls, stream mile 46.7.

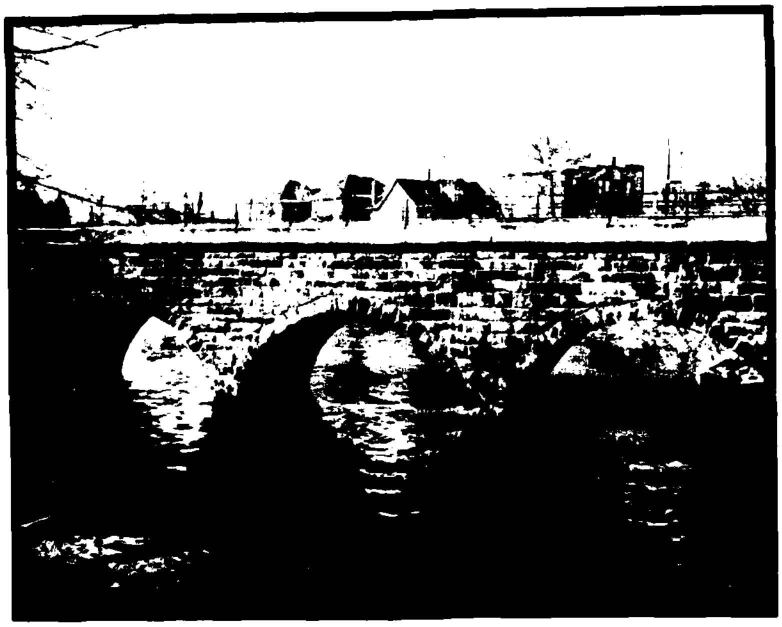


Figure 19 - Upstream face of the Penn Central Transportation Company bridge, stream mile 47.35. (Note skew of bridge)

Obstructions to flood flows
Photographs were taken in December 1970.

FLOOD SITUATION

FLOOD STAGES AND DISCHARGES - Table 5 lists flood crests and peak discharges for the known floods exceeding bankfull stage of 9.0 feet at the Old Portage gage. (See figure 20) A discharge of approximately 3,500 cfs will produce a stage of 9.0 feet at the gage.

Plate 2 shows known crest stages and years of occurrence of floods since 1913 which have exceeded the bankfull stage of 9.0 feet at the gage.

Figure 20 - U.S.G.S. gaging station at Old Portage, which is located on right bank upstream of the Akron-Peninsula Road bridge, stream mile 40.27.

Photograph was taken in December 1970.

TABLE 5

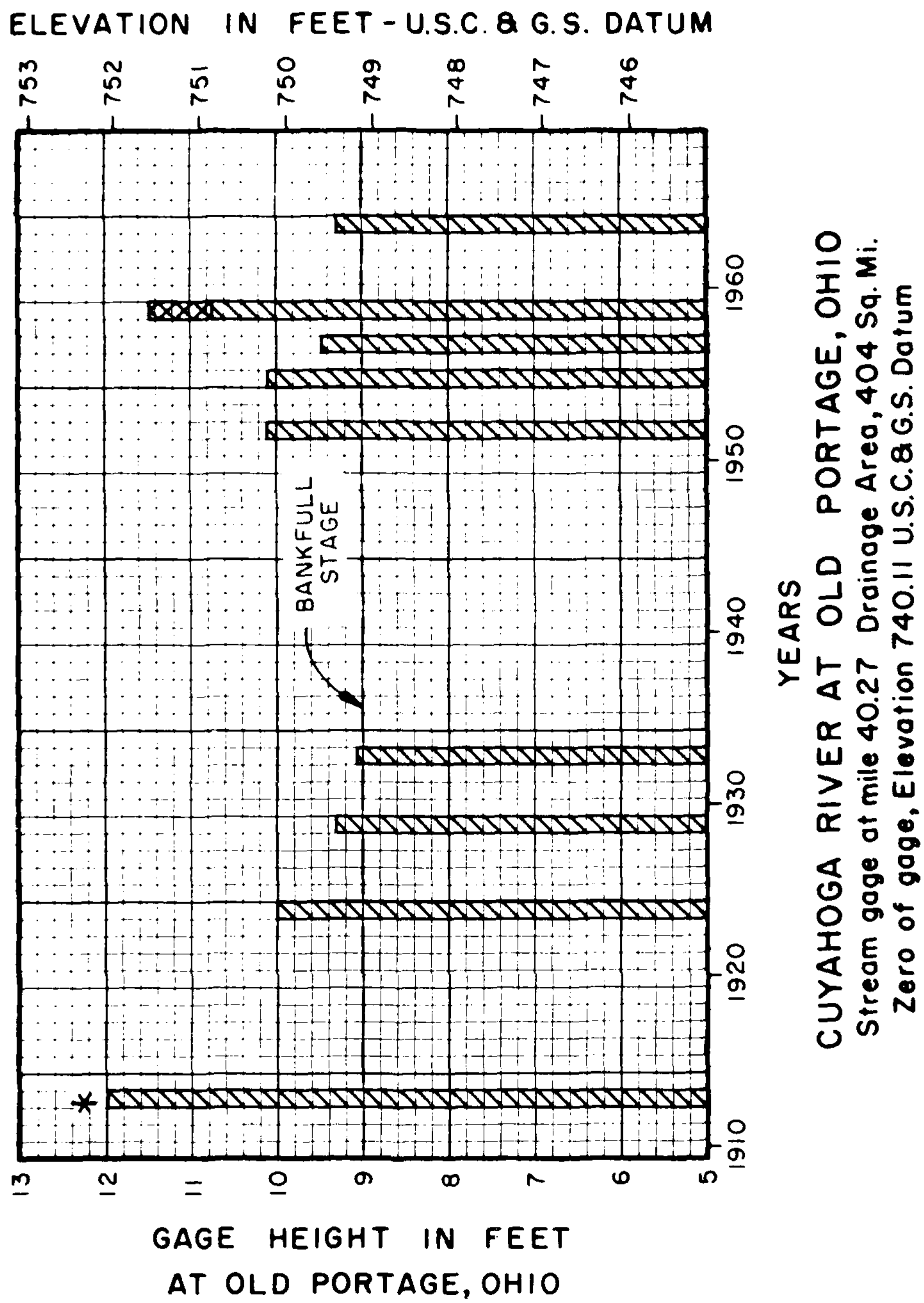
KNOWN FLOODS, CUYAHOGA RIVER AT OLD PORTAGE, OHIO

The table includes all known floods above bankfull stage of 9.0 feet at the U.S. Geological Survey gaging station just upstream of the Akron-Peninsula Road bridge which is about 4 miles northwest of Akron. Drainage area = 404 square miles. Zero of gage = 740.11 feet above mean sea level, unadjusted (USC & GS Datum)

Gage Heights

Date of Crest	Stage	Elevation	Discharge
	feet (1)	feet (1)	cfs
March 1913	12.0 (2)	752.11 (2)	7,600 (2)
21 January 1959	11.5	751.61	6,500
10 February 1959	10.75	750.86	5,300
26 January 1952	10.1	750.21	4,540
16 November 1955	10.1	750.21	4,540
28 June 1924	10.0	750.11	4,450
8 July 1957	9.5	749.61	4,000
10 March 1964	~~9.35~~ 10.1	~~749.46~~ 750.21	~~3,850~~ 4540
5 April 1929	9.3	749.41	3,820
14 March 1933	9.1	749.21	3,560

(1) Based on existing stage-discharge relationship.
(2) Estimated by U. S. Army Corps of Engineers.



NOTE:

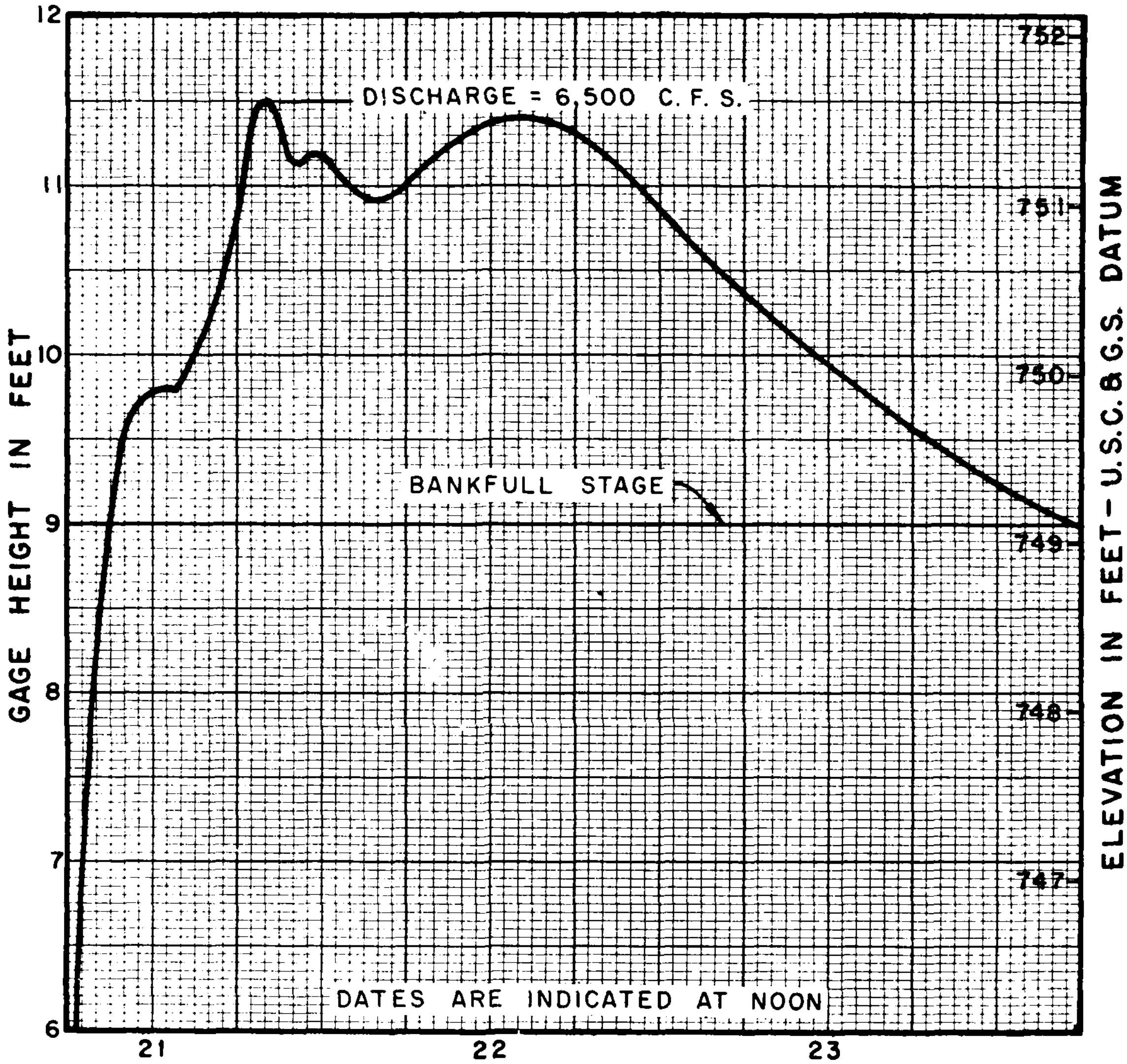
* Indicates flood estimated by U.S. Army, Corps of Engineers.

Variation in shading on the bar graph indicates more than one flood during the year.

CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

FLOODS ABOVE BANKFULL STAGE

U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971



JANUARY 1959

OLD PORTAGE, OHIO

NOTES:

Old Portage automatic recording gage at stream mile 40.27
Zero of Gage = 740.11 U.S.C. & G.S.
Bankfull stage = 9 ft. or El. 749.11
Drainage Area = 404 Sq. Mi.

CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

STAGE HYDROGRAPH

U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

DURATION AND RATE OF RISE - Plate 3 shows the stage hydrograph of the January 1959 flood at the U.S.G.S. gaging station on the Cuyahoga River at Old Portage. At the gage site during this flood the river rose to its crest in 26 hours at an average rate of rise of 0.4 foot per hour with a maximum rate of 1 foot in an hour and remained above bankfull (flood) stage for 69 hours.

VELOCITIES - During the January 1959 flood the average channel velocity was approximately two to five feet per second in the mildly sloped reaches. Overbank velocities ranged up to 1.5 feet per second. During a Standard Project Flood, velocities in the channel and overbank would be larger.

FLOODED AREAS, FLOOD PROFILES AND CROSS SECTIONS - Plates 5 through 7 show the approximate areas along the Cuyahoga River that would be inundated by the Intermediate Regional Flood and the Standard Project Flood. The approximate flood elevations of these floods are shown on plates 8 through 10. Typical valley cross sections in the study area are shown on plates 11 through 13.

FLOOD DESCRIPTIONS

Descriptions of known large floods that have occurred in the study area are based upon field investigations, historical records and newspaper accounts. The greatest flood of historical record occurred in March 1913. A condensation of available information on these flood occurrences is given in the following paragraphs. This information is presented as an example of the type and extent of flood problems which have already occurred and an indication of possible future flood problems.

23-26 MARCH 1913 - The storm which caused the greatest flood of historical record in the Cuyahoga River basin developed from the stagnation of a tropical marine air mass from the Gulf of Mexico against a cold air mass from Canada. Heavy rains occurred during the periods 13-15 and 20-21 March. These rains were only preliminary to a severe storm which developed during the period of 23-26 March. This storm extended from Texas to Lake Erie with its center over Bellefontaine, Ohio, 125 miles southwest of the Cuyahoga basin. Two low-pressure centers continued to form a long trough of low pressure which caused excessive rainfall in Ohio and neighboring states for about 60 hours. A record total of 11.16 inches of rainfall fell in Bellefontaine in 92 hours. Along the northeast edge of the storm the Cuyahoga basin received an average of 9.65 inches of rainfall in a 96-hour period. On 23 March 1.85 inches fell; on 24 March 4.75 inches fell; on 25 March 1.89 inches fell; on 26 March 1.16 inches fell. Because of four days of rain, the Cuyahoga River overtopped its banks and brought death and disaster to the valley. Big Reservoir in the Portage Lakes district gave way with millions of gallons of water pouring down the Ohio Canal. The Cuyahoga River was transformed into a rage sweeping everything before it. The flood crest at the Old Portage gage was elevation 752.1 (U.S.C. & G.S. datum).

25-26 JANUARY 1952 - Heavy rain occurred on 25-26 January 1952 over most of Ohio and caused many rivers to go on a rampage. At the Akron-Canton Airport Weather Station, 2.00 inches of rain fell in a 30-hour period over these two days. The maximum rainfall was 0.59 inch in a 3-hour period on 26 January. The severe storm on the 25th and 26th gave record breaking 24-hour precipitation measurements in many areas of Ohio. Some residents were forced to evacuate their homes. High water overtopped a culvert at North Moreland Boulevard and Vancouver Avenue in Cuyahoga Falls and washed away a section of road. Water reached as high as 18 inches over some streets. Some homes had 3 feet of water in their basements.

20-21 JANUARY 1959 - A storm developed from a large mass of cold air over northwestern Canada, a flow of warmer air from the southwest and the associated frontal system. Heavy rains began when the moisture-laden air from the south and the cold front converged. The storm was centered approximately 150 miles southwest of the Cuyahoga River basin. High water caused by two days of rain on 20-21 January 1959 inflicted damage in not only parts of Summit County but throughout the State of Ohio. More rain than usually falls in the whole month of January was dumped on the Akron area on these two days causing widespread damage to homes and highways. Some families were forced to evacuate their homes by boat. Mayor Emmett R. Wolfe of Cuyahoga Falls brought in off-duty firemen to help rescue stranded homeowners and to turn off utilities in flooded basements. During January 1959 temperatures were several degrees below normal. When the temperatures reached -5^{o} on the 18th the ground became frozen. At the Akron Sewage Works 2.86 inches of rain fell during a 30-hour period on 20-21 January. In a 3-hour period on 21 January 0.82 inch of rain fell. Although total rainfall for the storm was not excessive, intensities were high and runoff was increased by the frozen ground and the 6-inch snow cover on the basin. Following the rainfall, there was a warming trend which contributed snow melt. Rainfall averaged 2.34 inches over the entire basin; runoff from rainfall

and snow melt averaged 2.94 inches. Three of the five Cuyahoga Falls' water pumping stations were surrounded by swirling water. The Cuyahoga River swelled 700 feet beyond its banks at the Waterworks Park and surrounded three picnic shelter houses. The swollen river carried away 20 picnic tables from the park. At the Old Portage gage the January 1959 flood reached elevation 751.6, U.S.C. & G.S. datum, which is approximately 2.5 feet above bankfull stage. Flooding conditions in January 1959 are shown on figures 21 and 22.

This concludes the "General Conditions and Past Floods" section of this report. What can be done to prevent and/or reduce future flood damages? FLOOD PLAIN MANAGEMENT provides the solution! Wise flood plain management can control the use of the flood plain as a means of reducing damage caused by future flooding.

By using the flooded area maps, profiles and cross sections contained in this report is a guide, limited urban development can be allowed in the flood plain depending on the frequency of flooding. The elevations shown on the profiles should be used to determine flood heights because they are more accurate than the flooded outlines. Units of low damage construction should be stressed during future development in areas which are susceptible to frequent flooding. If it is uneconomical to elevate these lands, a means of flood proofing the structures should be given careful consideration.

As soon as possible, local governments should develop and enforce flood plain regulations based on the information contained in this report. This report provides local governments with the necessary tools to control the extent and type of development which would be allowed to take place within the flood plain. Regulation of the flood plain can usually be carried out most effectively by a combination of the several regulatory methods ... zoning ordinances, subdivision regulations and building codes. Local governments can also police and maintain the floodway so as to insure against the overgrowth of brush, weeds, debris and large trees which obstruct flood flows. All of these factors result in increased river stages. The U. S. Army Corps

of Engineers has prepared and is distributing to state, county and local governments for public dissemination two pamphlets, "Guidelines for Reducing Flood Damages" and "Introduction to Flood Proofing." The combination of data presented in this report and in the pamphlets will provide general guidelines for flood damage reduction in future development within the Cuyahoga River flood plain. Figure 23 lists the corrective and preventive measures described in the above mentioned pamphlets. The U. S. Army Corps of Engineers will distribute to State, county and local governments other helpful pamphlets as well as additions to existing pamphlets when they are developed. Figures 24 through 27 are examples of wise flood plain use.

Figure 21 - Flooding conditions in January 1959 near South Park Drive in Silver Lake, stream mile 48.0.

Photograph courtesy of Jay A. Breth
Silver Lake, Ohio

Figure 22 - Flooding conditions in January 1959 at Waterworks Park, stream mile 48.6.

Photograph courtesy of John Sager
Cuyahoga Falls, Ohio

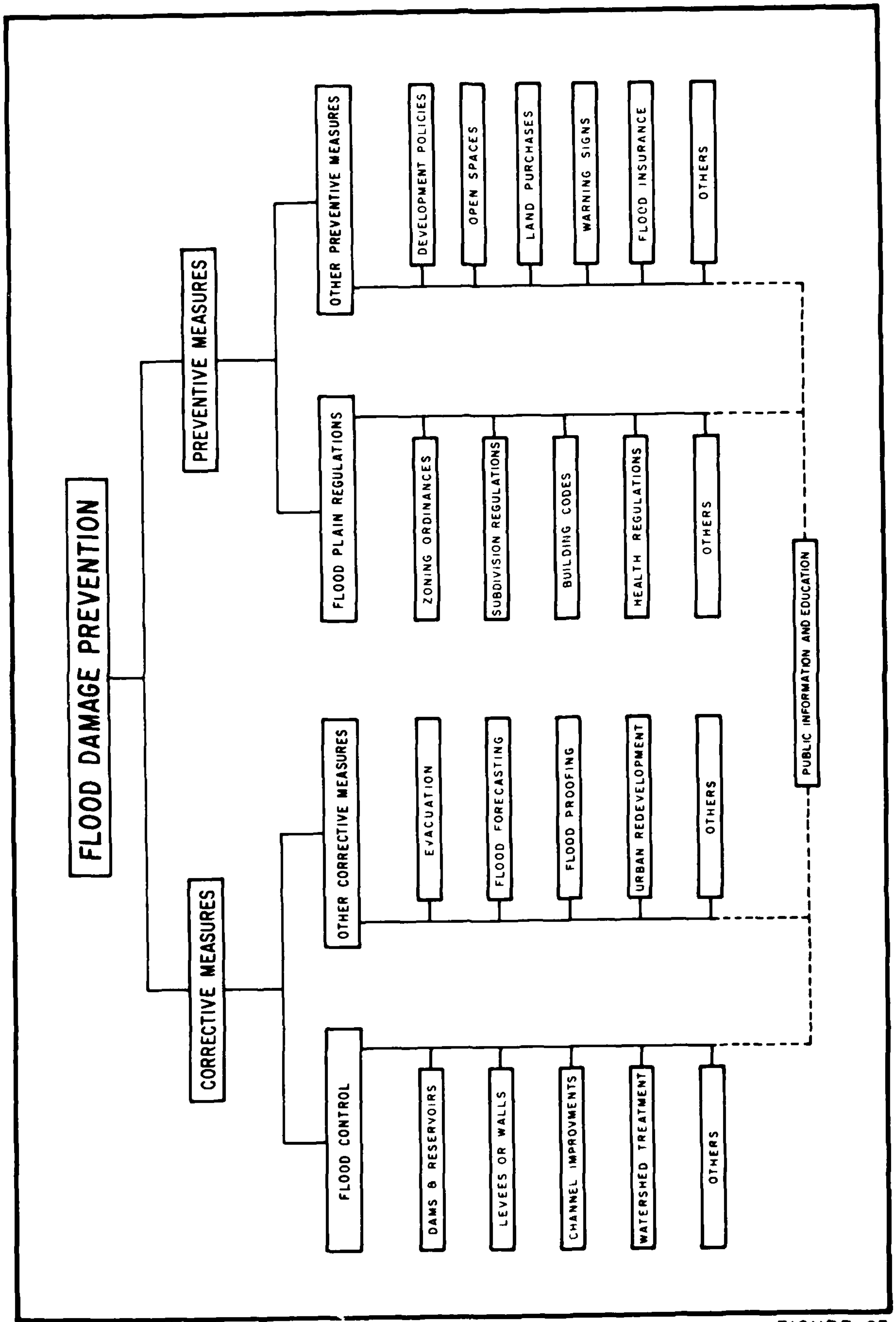

FLOOD DAMAGE PREVENTION
CORRECTIVE MEASURES
PREVENTIVE MEASURES
FLOOD CONTROL
DAMS & RESERVOIRS
LEVEES OR WALLS
CHANNEL IMPROVMENTS
WATERSHED TREATMENT
OTHERS
OTHER CORRECTIVE MEASURES
EVACUATION
FLOOD FORECASTING
FLOOD PROOFING
URBAN REDEVELOPMENT
OTHERS
FLOOD PLAIN REGULATIONS
ZONING ORDINANCES
SUBDIVISION REGULATIONS
BUILDING CODES
HEALTH REGULATIONS
OTHERS
OTHER PREVENTIVE MEASURES
DEVELOPMENT POLICIES
OPEN SPACES
LAND PURCHASES
WARNING SIGNS
FLOOD INSURANCE
OTHERS
PUBLIC INFORMATION AND EDUCATION

FIGURE 23

Figure 24 - Valley View Golf Course, stream mile 41.9.

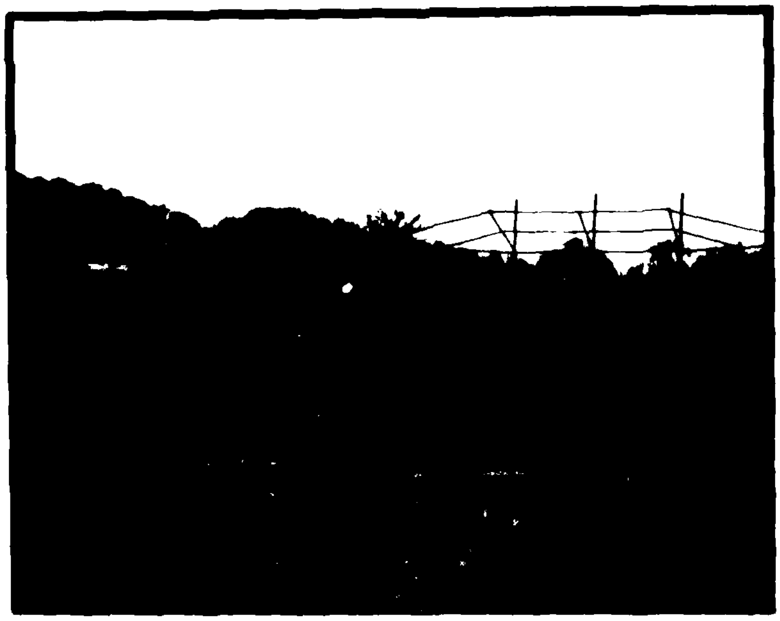


Figure 25 - Athletic field, stream mile 42.8.

Examples of wise flood plain use
Photographs were taken in December 1970.

Figure 26 - Akron Metropolitan Park, stream mile 44.9.

Figure 27 - Waterworks Park, stream mile 48.6.

Examples of wise flood plain use
Photographs were taken in December 1970.

Figure 28 - Available lots along Kent Road in Silver Lake, stream mile 49.0.

Example of poor flood plain use
Photograph was taken in December 1970.

FUTURE FLOODS

In order to determine future floods, it is desirable to study past floods on other streams in the same general region. Table 6 lists the maximum known floods at various U.S.G.S. gaging stations.

This section of the report discusses two future floods: the Intermediate Regional Flood and the Standard Project Flood on the Cuyahoga River.

The Standard Project Flood is a severe flood of infrequent occurrence. It is possible, but unlikely, that a flood of greater magnitude could occur. The Standard Project Flood concept developed by the U. S. Army Corps of Engineers provides an indication of the upper limit of flooding in a particular area and is used to compare floods in different locations throughout the United States.

The Intermediate Regional Flood may reasonably be expected to occur more frequently than the Standard Project Flood. To avoid possible damage from floods of Intermediate Regional or Standard Project magnitude, flood plains should not be developed without consideration to possible future flood elevations, the risks involved, and possible alternatives.

TABLE 6

MAXIMUM KNOWN FLOOD DISCHARGES AT U.S.G.S. GAGING STATIONS IN THE REGION OF CUYAHOGA RIVER, OHIO

Stream	Location Ohio	Period of Record (years)	Drainage Area (sq. mi.)	Date	Peak Discharge of Record Amount (cfs) ~~Date~~	Peak Discharge of Record Amount per sq mi. (cfs)	Estimated Recurrence Interval (years)
Cuyahoga River	Independence (1)	41	707	22 Jan. 1959	21,400 (3)	29.7	100
Cuyahoga River	Old Portage	46	404	21 Jan. 1959	6,500	16.1	200
Sandusky River	Fremont (2)	44	1,251	10 Feb. 1959	28,000 (4)	22.4	10
Huron River	Milan	20	371	5 July 1969	49,600	131.8	200
Vermilion River	Vermilion	18	262	6 July 1969	40,800	155.7	100
Black River	Elyria	25	396	6 July 1969	51,700	130.6	greater than 200
Rocky River	Berea	37	267	22 Jan. 1959	21,400	80.1	70
Chagrin River	Willoughby	40	246	22 Mar. 1948	28,000	113.8	60
Grand River	Madison	45	581	22 Jan. 1959	21,100	36.3	100
Ashtabula River	Ashtabula	41	121	22 Jan. 1959	11,600	95.9	50
Conneaut Creek	Conneaut	34	175	22 Jan. 1959	17,000	97.1	60

(1) The estimated peak discharge of the maximum flood of record was 30,000 cfs for the 1913 flood. It has a recurrence interval on the order of once in 200 years.

(2) The estimated peak discharge of the maximum flood of record was 63,500 cfs for the 1913 flood. It has an exceedance interval of about 200 years based on a discharge-frequency basis and about 200 years on a stage frequency basis.

(3) Estimated by Corps of Engineers.

(4) Estimated by U.S.G.S.

DETERMINATION OF INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is defined as a flood having a recurrence interval of once in 100 years at a designated location. However, this flood may occur in any one year or in consecutive years. A statistical analysis of stream flow records available for the basin under study is often used to determine a frequency of occurrence, but limitations in such records usually require analysis of rainfall and runoff characteristics in the "general region" of the area. Although the Intermediate Regional Flood represents a major flood, it is much less severe than the Standard Project Flood.

Results of the studies indicate that the Intermediate Regional Flood on Cuyahoga River at the Old Portage gaging station would have a peak discharge of 5,820 cubic feet per second.

DETERMINATION OF STANDARD PROJECT FLOOD

Only in rare instances has a specific stream experienced the largest flood than can be expected to occur. It is a commonly accepted fact that sooner or later a larger flood can and probably will surpass the maximum known flood on a given stream. The Corps of Engineers, in cooperation with the National Weather Service, has made broad and comprehensive studies and investigations based on the records of past storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. The Standard Project Flood is defined as the flood that can be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical region involved. Although the Standard Project Flood has only a rare chance of occurrence, it is not the most severe flood that could occur. The Standard Project Storm rainfall used for the Cuyahoga River at Old Portage gage amounts to 0.32 inch for 24 hours, 1.73 inches for 48 hours, 8.44 inches for 72 hours, and a total of 8.99 inches in 96 hours. Rainfall of this magnitude has recently been recorded in the region. In July 1969 in

Wooster, Ohio 9.37 inches of rain fell in 24 hours, and a total of 10.69 inches fell in 96 hours. The peak discharge of the Standard Project Flood on Cuyahoga River at the U.S.G.S. gaging station at Old Portage is 41,100 cfs. The Standard Project Flood discharge was based on the assumption that there would be no storage in the reservoirs in the upper basin of the Cuyahoga River.

FREQUENCY - It is not practical to assign a frequency to a Standard Project Flood. Generally its recurrence interval would be more rare than once in 500 years. However, the flood could occur during any year.

POSSIBLE LARGER FLOODS - Floods larger than the Standard Project Flood are possible. However, the combination of factors that would be necessary to produce such floods seldom occur.

HAZARDS OF GREAT FLOODS

AREAS FLOODED AND HEIGHTS OF FLOODING - The areas along the Cuyahoga River inundated by the Standard Project and Intermediate Regional Floods are shown on plates 5 and 7. Depths of flow for the Standard Project Flood, the Intermediate Regional Flood, and the January 1959 flood can be estimated from the valley sections which are shown on plates 11 through 13.

The January 1959, the Intermediate Regional and the Standard Project flood profiles were computed by using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps and valley cross sections. The overflow areas shown on plates 5 through 7 and the water surface profiles shown on plates 8 through 10 have been determined with an accuracy consistent with the purpose of this study and the accuracy of the available basic data. The water surface profiles depend to a great extent upon the degree of destruction or clogging of various bridges during the flood occurrence. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand and that no clogging would occur.

In the study area the Standard Project Flood for the Cuyahoga River averages approximately 12 to 15 feet higher than the January 1959 flood stage.

Upstream of the confluence of the Little Cuyahoga River, the Intermediate Regional Flood profile averages approximately one foot higher than the 1959 flood stage.

The approximate heights of the Standard Project Flood, the Intermediate Regional Flood, and the January 1959 flood at selected sites are shown in figures 29 through 35.

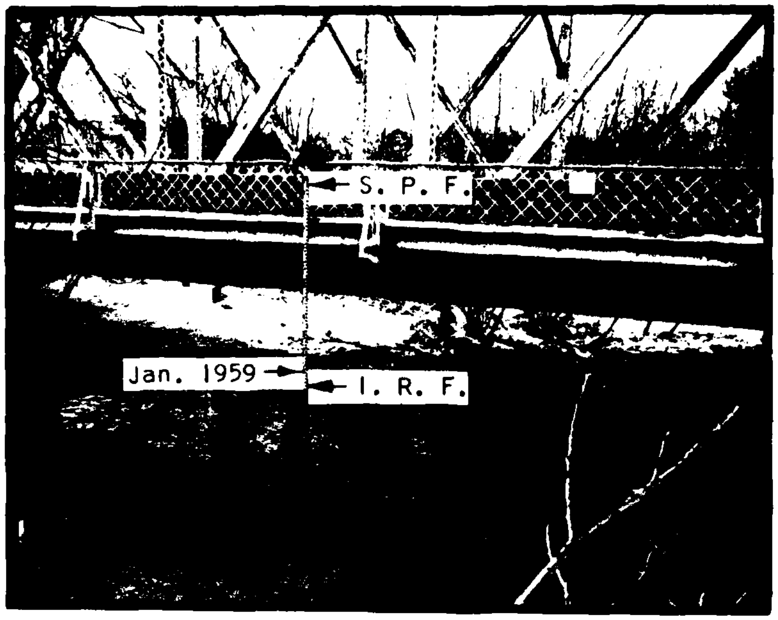


Figure 29 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and the January 1959 floods.at the upstream face of the Akron-Peninsula Road bridge, stream mile 40.25.

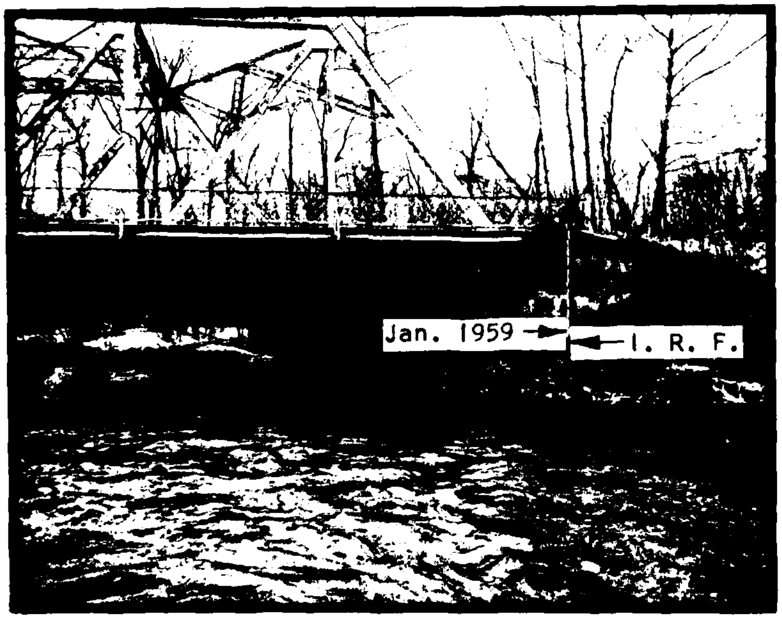


Figure 30 - Arrows indicate the heights of the Intermediate Regional and the January 1959 floods at the upstream face of the Cuyahoga Street bridge, stream mile 42.77.

Possible future flood heights
Photographs were taken in December 1970.

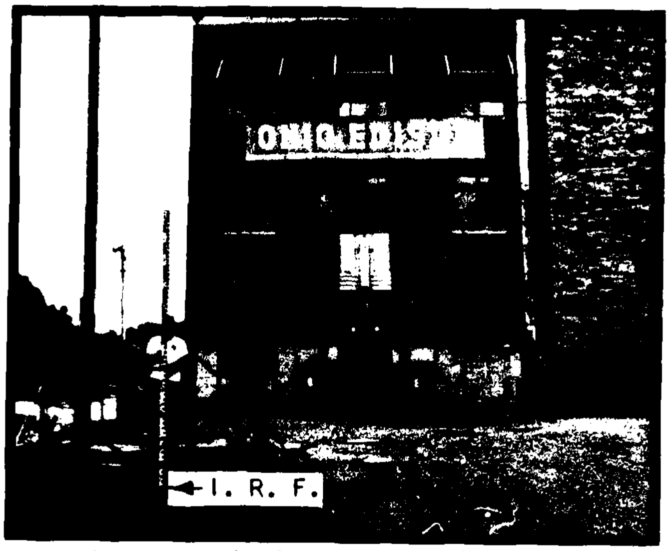


Figure 31 - Arrow indicates the height of the Intermediate Regional Flood at the Ohio Edison Company, stream mile 45.20.

Photograph was taken in May 970.

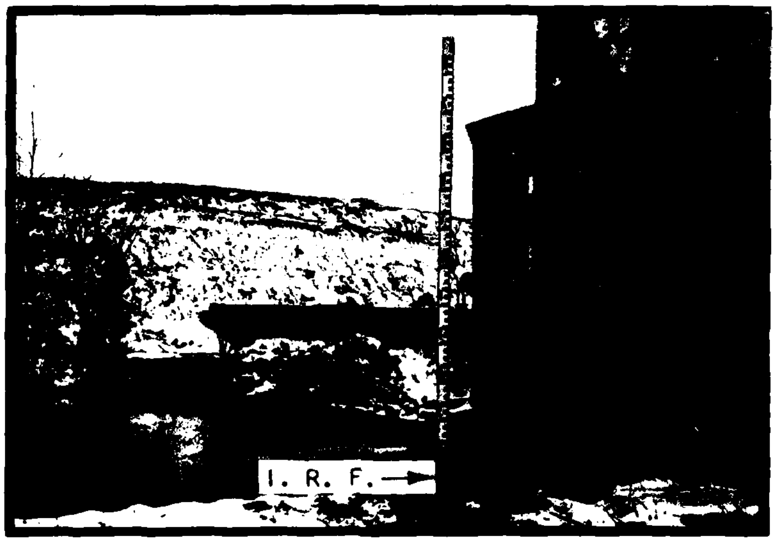


Figure 32 - Arrow indicates the height of the Intermediate Regional Flood upstream of dam in Cuyahoga Falls, stream mile 46.63.

Possible future flood heights
Photograph was taken in December 1970.

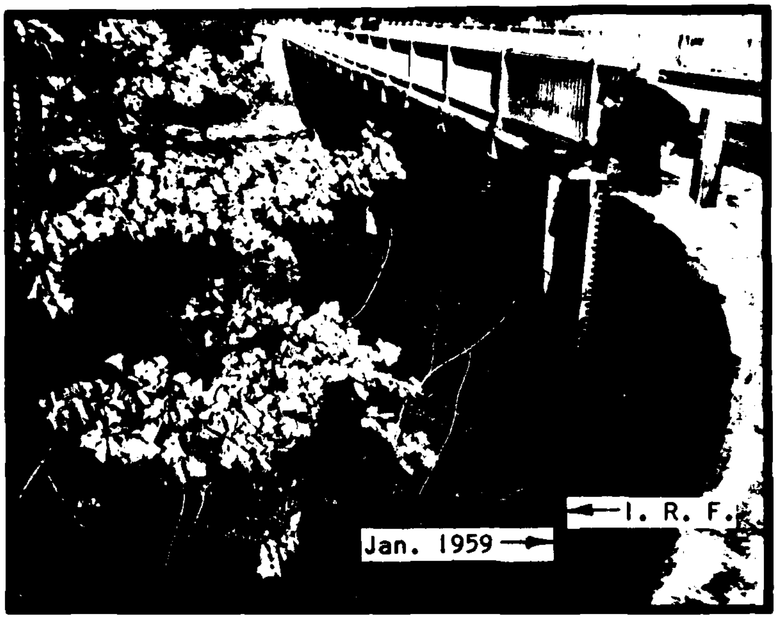


Figure 33 - Arrows indicate the heights of the Intermediate Regional and the January 1959 floods at the downstream face of Oak Park Blvd. in Cuyahoga Falls, stream mile 47.72.

Figure 34 - Arrows indicate the heights of the Intermediate Regional and the January 1959 floods along South Park Drive in the Village of Silver Lake, stream mile 47.95.

Possible future flood heights
Photographs were taken in December 1970.

Figure 35 - Arrows indicate the heights of the Intermediate Regional and the January 1959 floods at the Sonoco Products Company, 59 N. Main St., Munroe Falls, stream mile 49.95.

Possible future flood heights
Photograph was taken in December 1970.

VELOCITIES, RATES OF RISE AND DURATION OF FLOODING - Table 7 lists the average velocities that would occur in the channel and overbank areas during the Intermediate Regional and Standard Project Floods.

Rates of rise are dependent upon the development, rainfall intensity, slope of the basin and loss rate of rainfall. They can also depend upon the condition of the channel and amount of debris in the channel at the time of the storm. The duration of a flood above bankfull stage is dependent upon the duration of the storm and on the assumption that the storm was caused by rainfall and does not include prolonged runoff from snow melt and high stages caused by ice jams, etc. Table 8 lists the total rise from low water to the crest, the maximum rate of rise, and the duration above bankfull stage of the Intermediate Regional and Standard Project Floods for the Cuyahoga River.

TABLE 7

AVERAGE MAXIMUM VELOCITIES

Location	Stream Mile	Flood	*Maximum Velocities channel (ft per sec)	overbank (ft per sec)
U.S.G.S. gage at Old Portage	40.27	Intermediate Regional	5.9	1.1
		Standard Project	9.7	3.6
Valley Section B	41.80	Intermediate Regional	3.7	0.8
		Standard Project	3.8	1.3
Valley Section C	43.77	Intermediate Regional	9.1	-
		Standard Project	16.8	5.3
Valley Section D	47.61	Intermediate Regional	2.5	0.3
		Standard Project	4.8	1.4
Valley Section F	51.87	Intermediate Regional	2.3	0.5
		Standard Project	5.0	1.6

*Average maximum velocity for selected location. Velocities could be greater in isolated areas, especially in overbank section. High channel and overbank velocities, in combination with deep, fairly long-duration flooding, would create a hazardous situation in the flood plain. When velocity (in feet per second) times depth (in feet) is greater than nine, hazardous conditions prevail.

TABLE 8

RATES OF RISE AND DURATIONS OF FLOODING
AT U.S.G.S. GAGE AT OLD PORTAGE
STREAM MILE 40.27

Flood	Time of rise (hrs)	Maximum rate of rise (ft/hr)	Duration above bankfull stage (hrs)
Intermediate Regional	30	0.7	58
Standard Project	53	0.6	135

These rates of rise should give adequate warning that a flood is coming. However, a clogged bridge or an ice jam could act as a dam and cause water to back up and form a pond. When sufficient head accumulates in the pond to break the jam, a surge of water would flow downstream causing an almost instantaneous rate of rise.

GLOSSARY OF TERMS

Discharge. The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain. The relatively flat area or low lands adjoining the channel of a river, stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by flood water.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth, for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Hydrograph. A curve denoting the discharge or stage of flow over a period of time.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed."

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance). See "underclearance."

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance. The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

AUTHORITY, ACKNOWLEDGMENTS AND INTERPRETATION OF DATA

PUBLIC LAW - This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (PL 86-465), as amended.

* * *

ACKNOWLEDGMENTS - The assistance and cooperation of the United States Geological Survey, National Weather Service, Ohio Department of Natural Resources, Tri-County Regional Planning Commission, various local governmental agencies in the study area, and private citizens in providing useful data are appreciated.

* * *

This report presents the local flood situation caused by the Cuyahoga River from Akron to the Summit-Portage County line. The U. S. Army Engineer District, Buffalo, will provide interpretation and limited technical assistance in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated through the Ohio Department of Natural Resources, Division of Water. After local authorities have selected the flood magnitude or frequency to be used as the basis for regulation, the Corps of Engineers can assist in the selection of floodway limits by providing information on the effects of various widths of floodway on the profile of the selected flood.


N
FLOW
CUYAHOGA
PLATE
AKRON

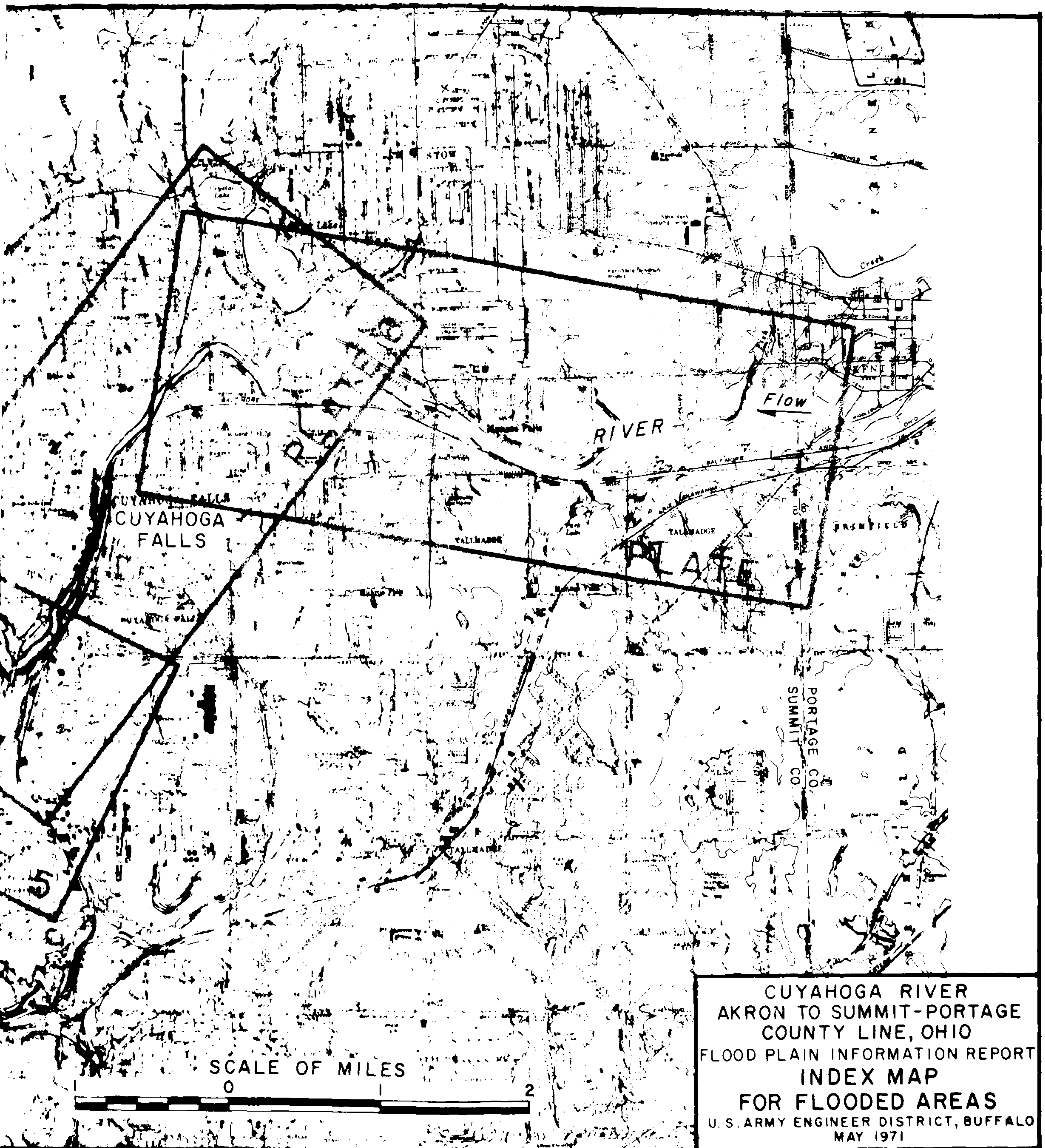
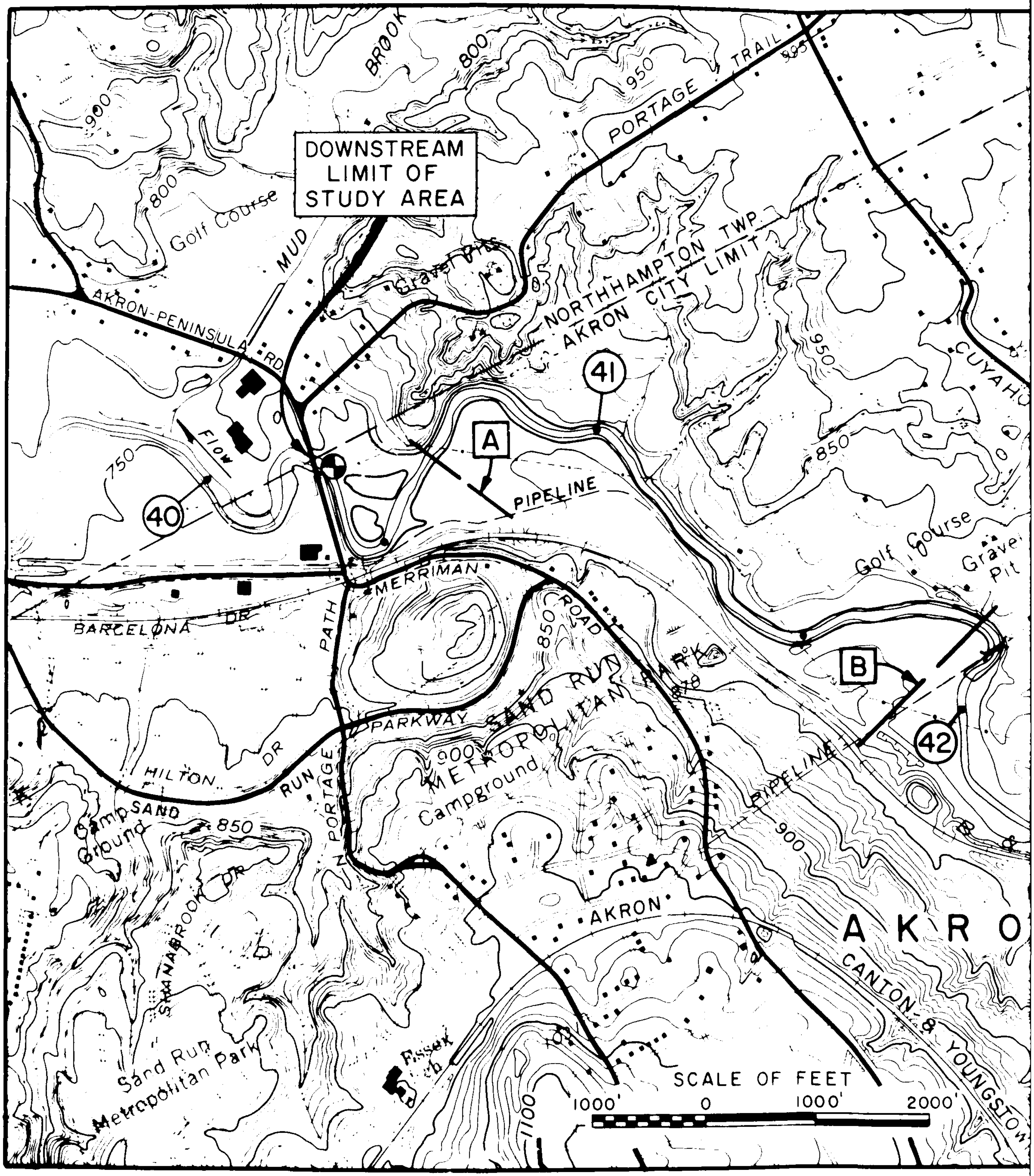
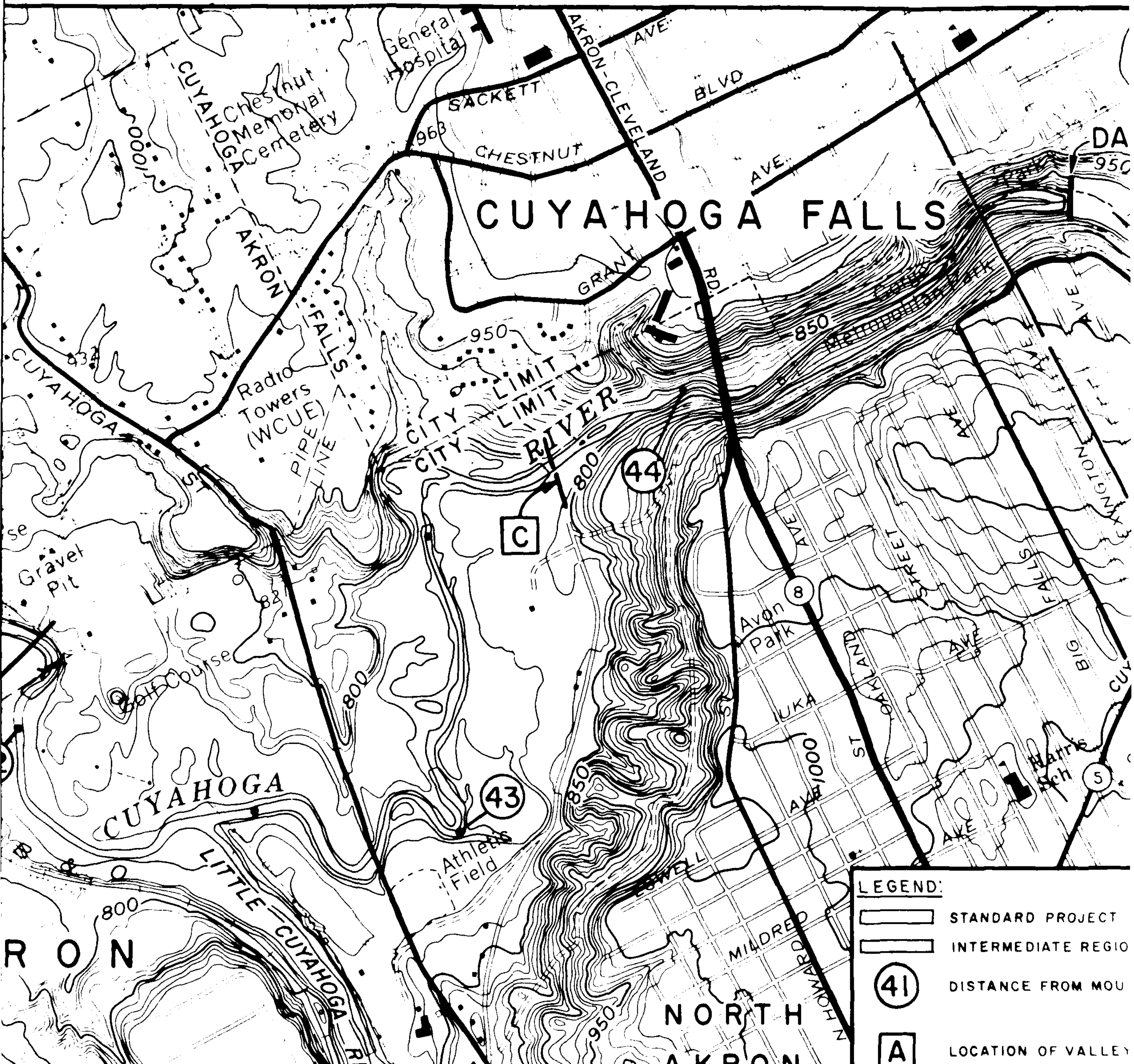

STOW
Flow
RIVER
CUYAHOGA
FALLS
TALLMADGE
PLATE
PLATE
5
PORTAGE CO.
SUMMIT CO.
SCALE OF MILES
1 0 1 2
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
INDEX MAP
FOR FLOODED AREAS
U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE 4


DOWNSTREAM
LIMIT OF
STUDY AREA
MUD
BROOK
PORTAGE TRAIL
Golf Course
Gravel Pits
NORTHHAMPTON TWP
AKRON CITY LIMIT
AKRON-PENINSULA RD
Flow
PIPELINE
A
B
40
41
42
MERRIMAN ROAD
BARCELONA DR
PATH
PORTAGE
PARKWAY
HILTON DR
RUN
SAND
SAND RUN PARK
METROPOLITAN
Campground
Camp Ground
SHANABROOK DR
Sand Run Metropolitan Park
AKRON
CANTON & YOUNGSTOWN
Golf Course
Gravel Pit
CUYAHO
AKRO
SCALE OF FEET
1000'
0
1000'
2000'
750
800
850
900
950
1100


CUYAHOGA FALLS
NORTH AKRON
RON
General Hospital
Chestnut Memorial Cemetery
SACKETT
CHESTNUT
AKRON-CLEVELAND RD
BLVD
AVE
GRANT
Radio Towers (WCUE)
PIPE LINE
CITY LIMIT
RIVER
CUYAHOGA
LITTLE CUYAHOGA RIVER
Gorge Metropolitan Park
Gravel Pit
Golf Course
Athletic Field
Avon Park
Harris Sch
YOUNGSTOWN RD
MALVERN
POWELL
MILDRED
UKA
N HOWARD ST
OAKLAND
FALLS AVE
BIG
CUYAHOGA
AKRON
FALLS
B & O
950
850
800
1000
963
44
43
C
8
5
LEGEND:
STANDARD PROJECT
INTERMEDIATE REGIO
41
DISTANCE FROM MOU
A
LOCATION OF VALLEY
U.S.G.S. WATER-STAGE
LIMITS OF OVERFLOW INDICA
FROM ACTUAL LOCATIONS ON
IN THIS REPORT.

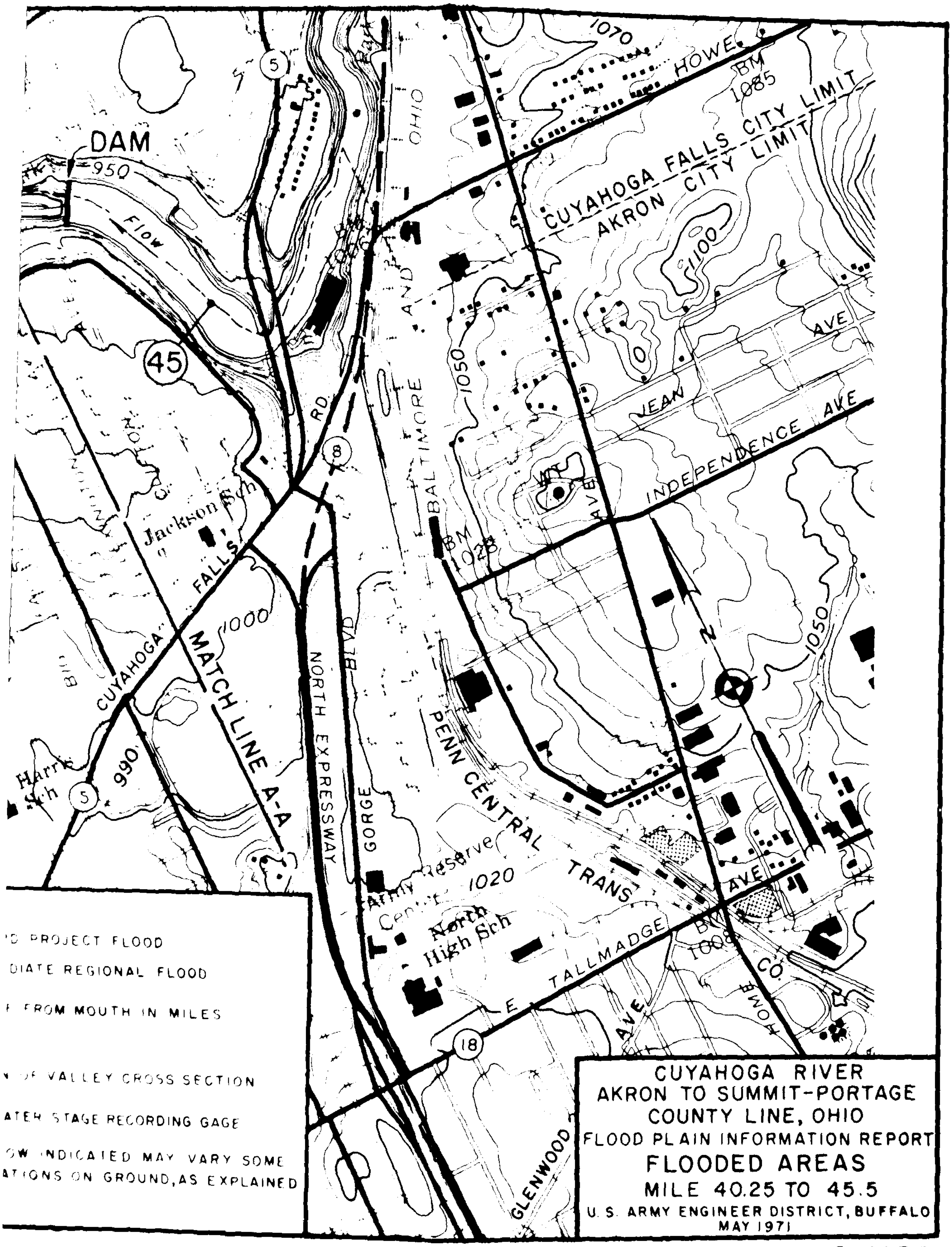
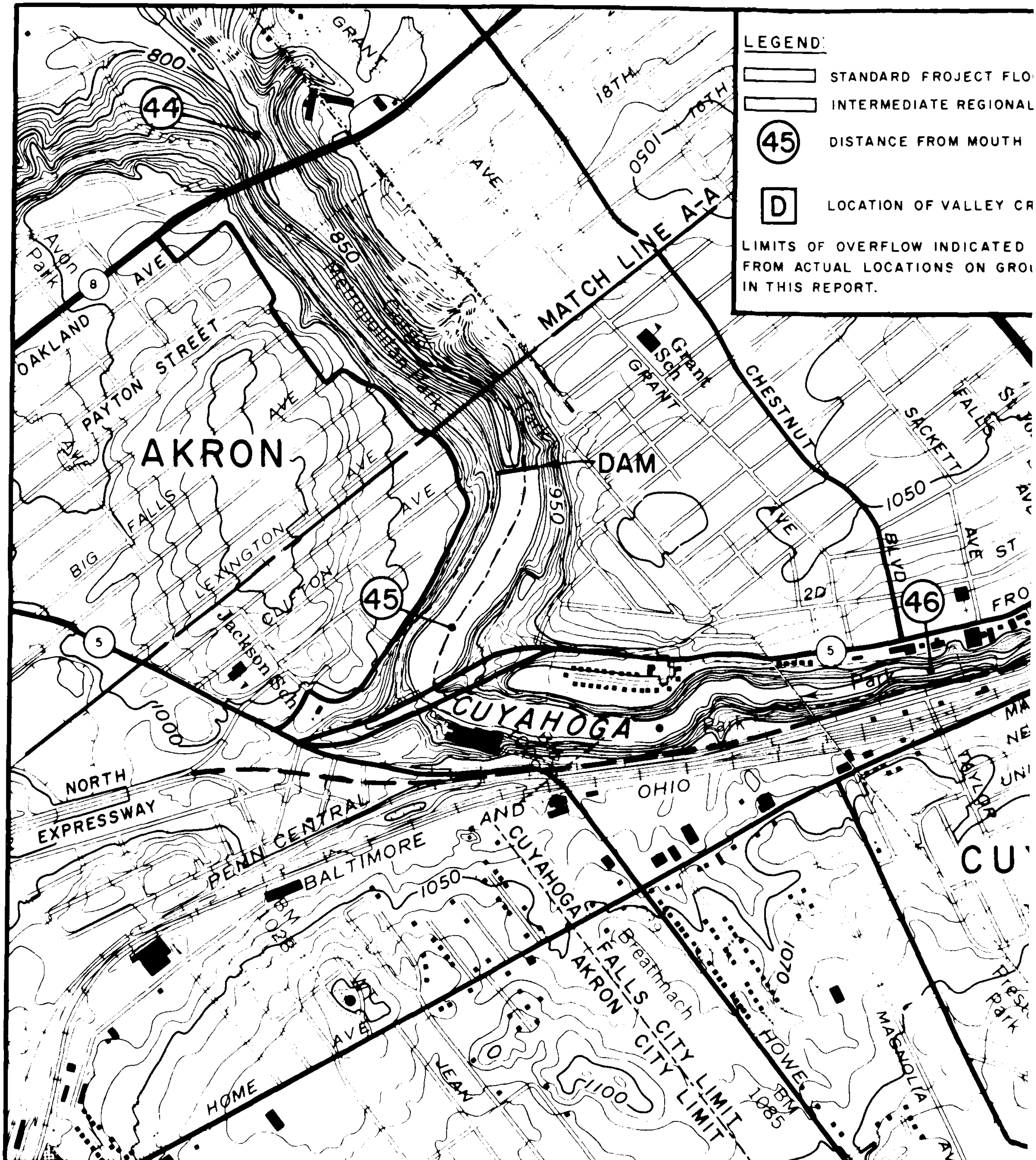
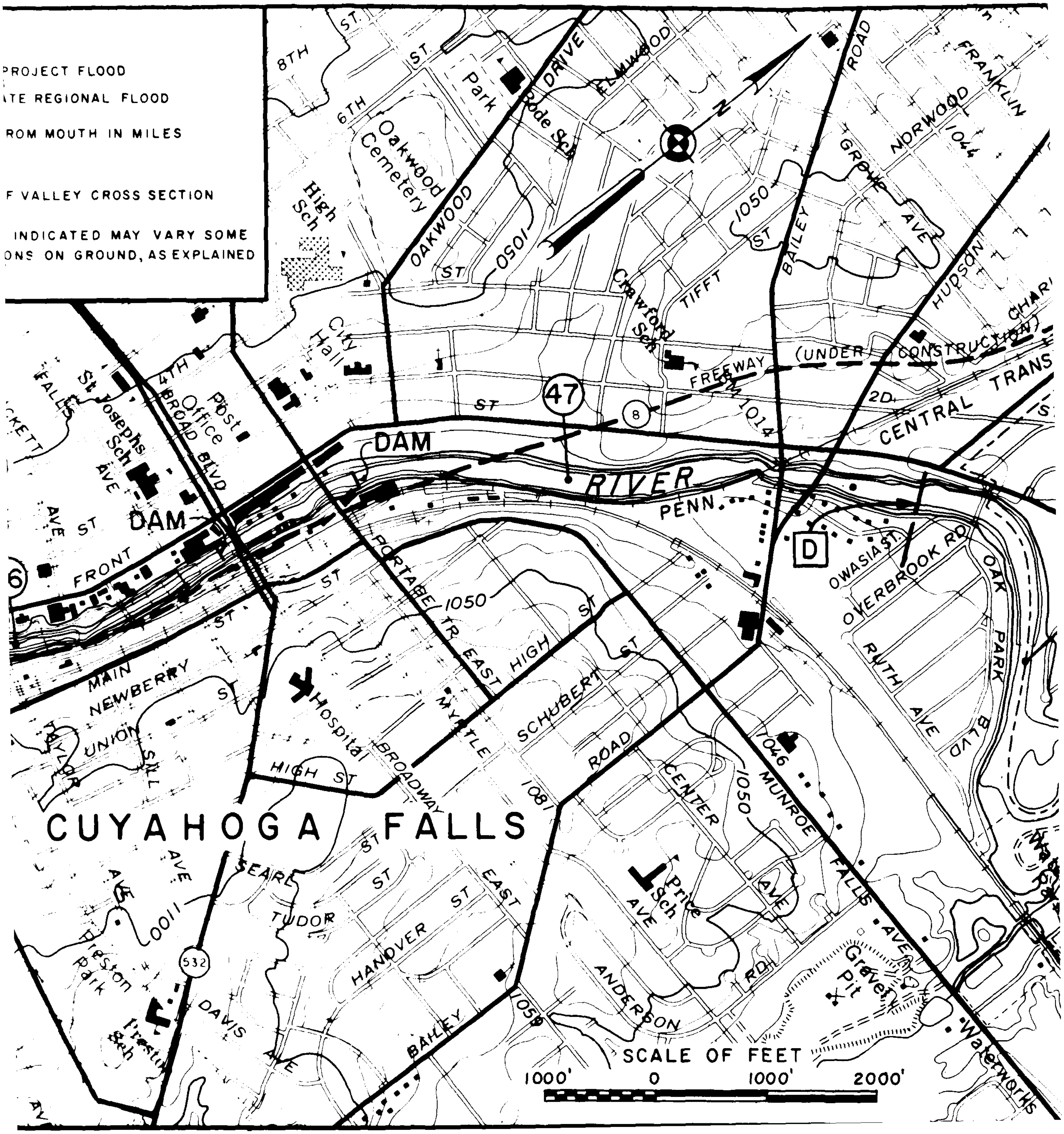

DAM
950
Flow
45
5
8
18
RD
OHIO
AND
BALTIMORE
1070
HOWE
BM 1085
CUYAHOGA FALLS CITY LIMIT
AKRON CITY LIMIT
1100
AVE
JEAN
INDEPENDENCE AVE
1050
BM 1028
N
Jackson Sch
FALLS
CUYAHOGA
1000
MATCH LINE A-A
NORTH EXPRESSWAY
BLVD
GORGE
PENN CENTRAL TRANS
990
Army Reserve Center
1020
North High Sch
E TALLMADGE AVE
HOWE
CO.
GLENWOOD
PROJECT FLOOD
REGIONAL FLOOD
FROM MOUTH IN MILES
VALLEY CROSS SECTION
STAGE RECORDING GAGE
INDICATED MAY VARY SOME
GROUND, AS EXPLAINED
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
FLOODED AREAS
MILE 40.25 TO 45.5
U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE 5



LEGEND:
STANDARD PROJECT FLO
INTERMEDIATE REGIONAL
45
DISTANCE FROM MOUTH
D
LOCATION OF VALLEY CR
LIMITS OF OVERFLOW INDICATED
FROM ACTUAL LOCATIONS ON GROU
IN THIS REPORT.
AKRON
CUYAHOGA
MATCH LINE A-A
DAM
44
45
46
800
850
950
1000
1050
1070
1100
GRANT
18TH
AVE
Avon Park
OAKLAND
PAYTON STREET
BIG FALLS AVE
LEXINGTON
CLINTON
Jackson Sch
Grant Sch
CHESTNUT BLVD
SACKETT
FALLS
2D
NORTH EXPRESSWAY
PENN CENTRAL
BALTIMORE AND OHIO
BM 1028
BM 1085
CUYAHOGA FALLS CITY LIMIT
AKRON CITY LIMIT
Breathnach
HOWE
MAGNOLIA
HOME AVE
JEAN
TAYLOR
CU



PROJECT FLOOD
ATE REGIONAL FLOOD
ROM MOUTH IN MILES
F VALLEY CROSS SECTION
INDICATED MAY VARY SOME
ONS ON GROUND, AS EXPLAINED
CUYAHOGA FALLS
DAM
RIVER
DAM
47
D
8
532
FREEWAY (UNDER CONSTRUCTION)
CENTRAL
Oakwood Cemetery
High Sch
City Hall
Post Office
St Josephs Sch
Park
Bode Sch
Crawford Sch
Hospital
Price Sch
Preston Park
Gravel Pit
Waterworks
OAKWOOD
DRIVE
ELMWOOD
ROAD
FRANKLIN
NORWOOD
GROVE AVE
BAILEY
HUDSON
TIFFT
ST
4TH
BROAD BLVD
FRONT
MAIN
NEWBERRY
UNION
HIGH ST
BROADWAY
PORTAGE TR EAST
MYRTLE
SCHUBERT
ROAD
CENTER
MUNROE
FALLS AVE
OWASIA ST
OVERBROOK RD
RUTH AVE
OAK PARK BLVD
PENN
SEARL
TUDOR
HANOVER ST
DAVIS AVE
ANDERSON RD
BAILEY
1050
1046
1081
1014
1044
1059
1100
SCALE OF FEET
1000'
0
1000'
2000'

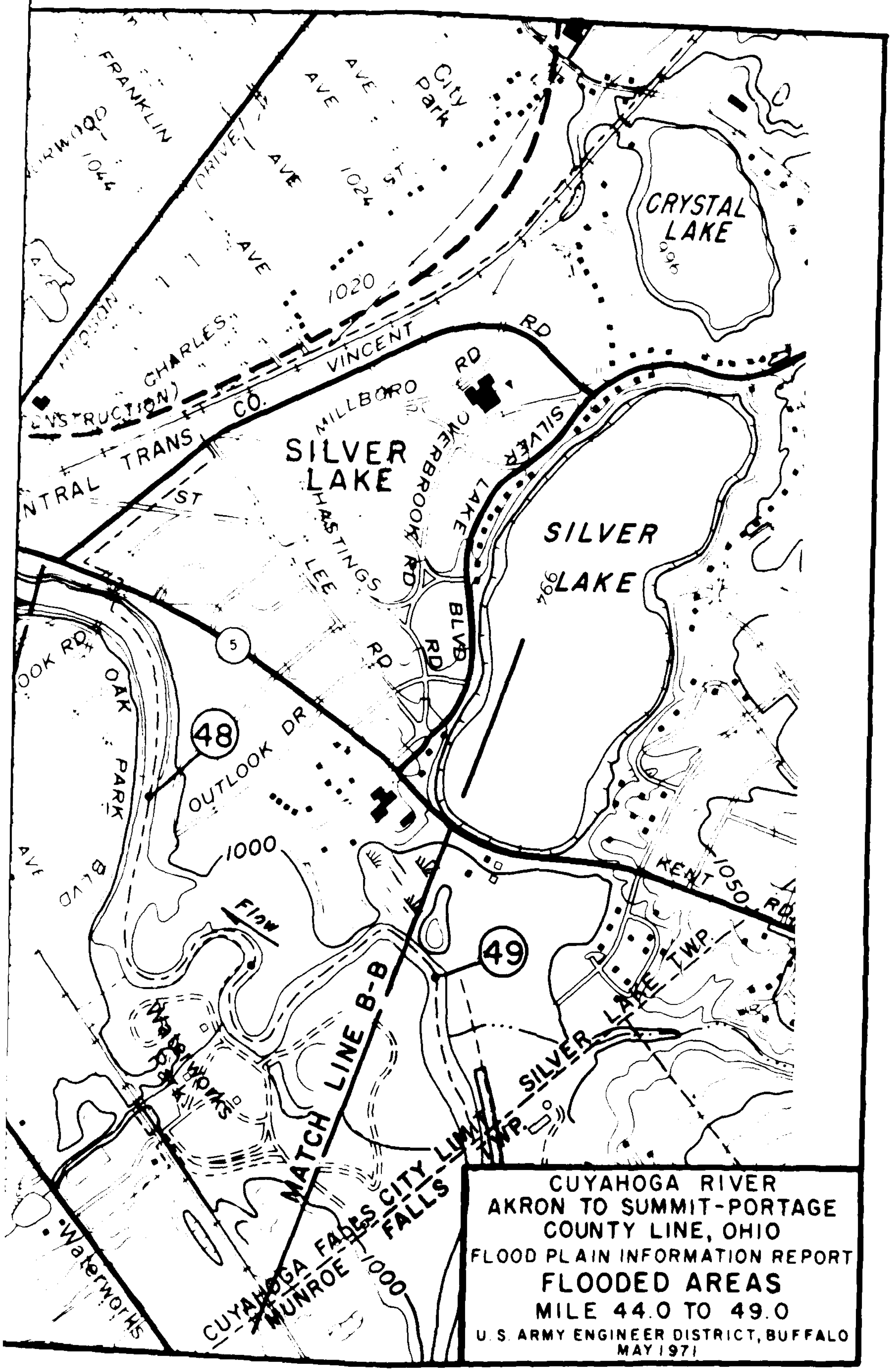
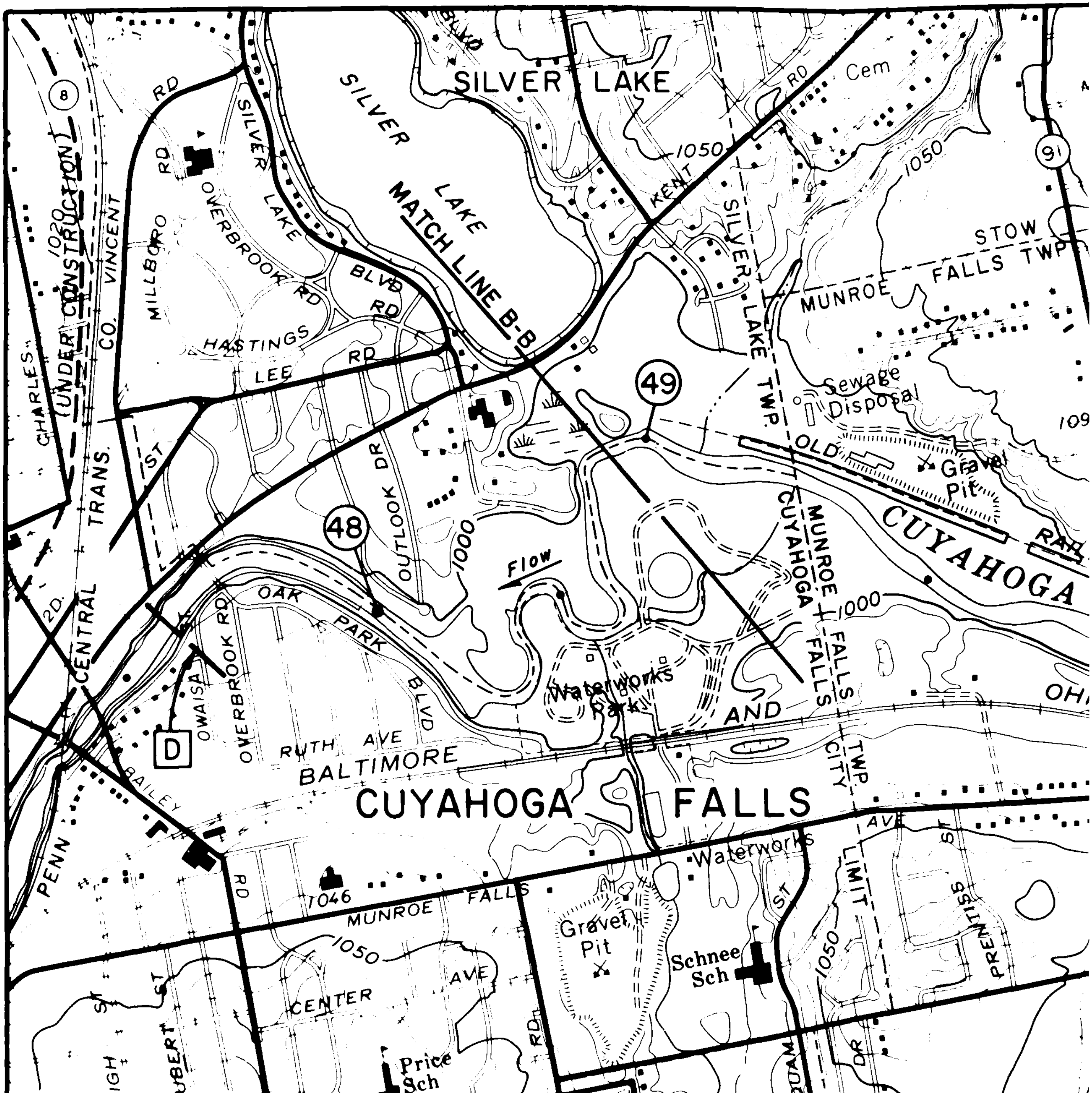
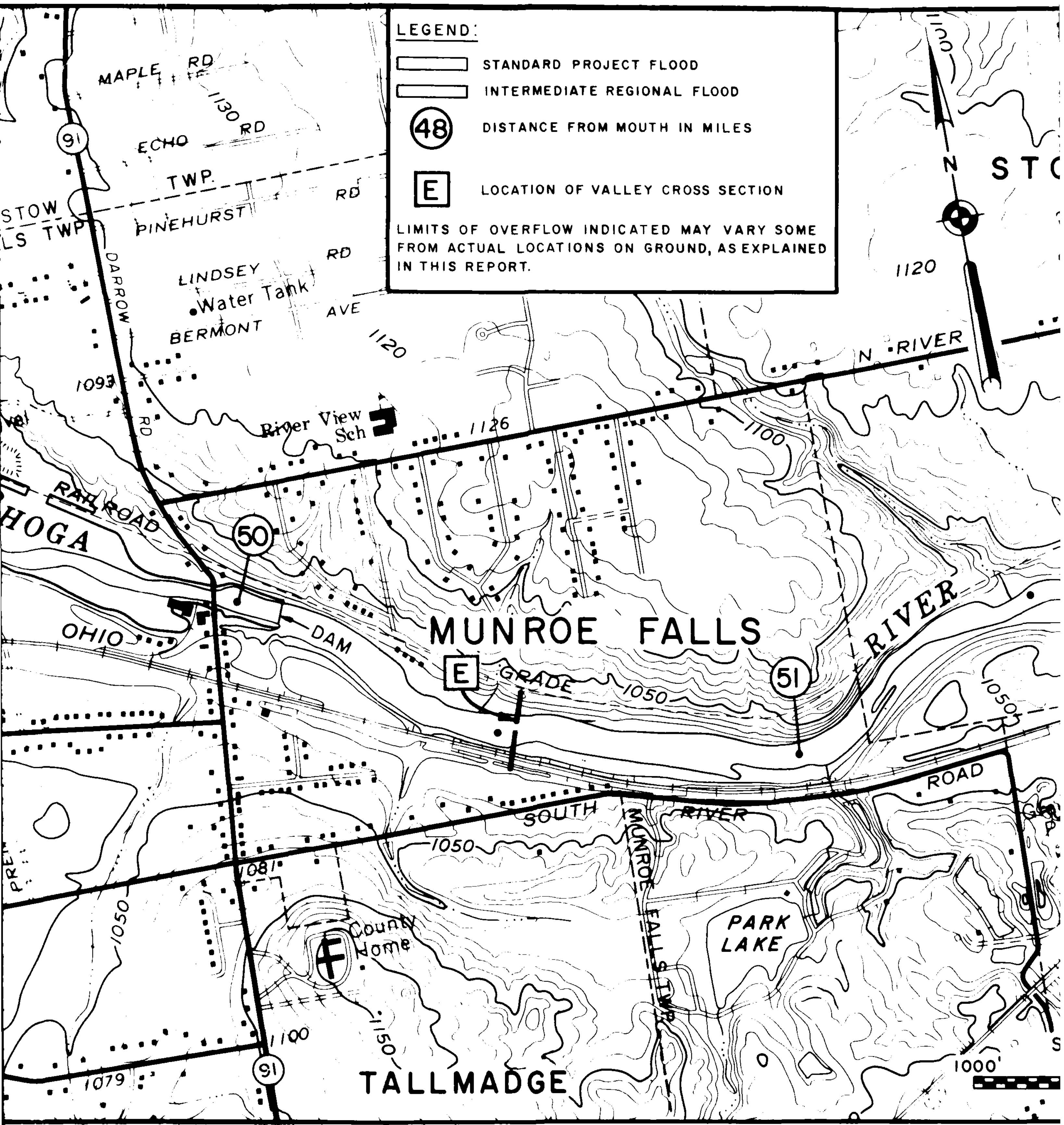
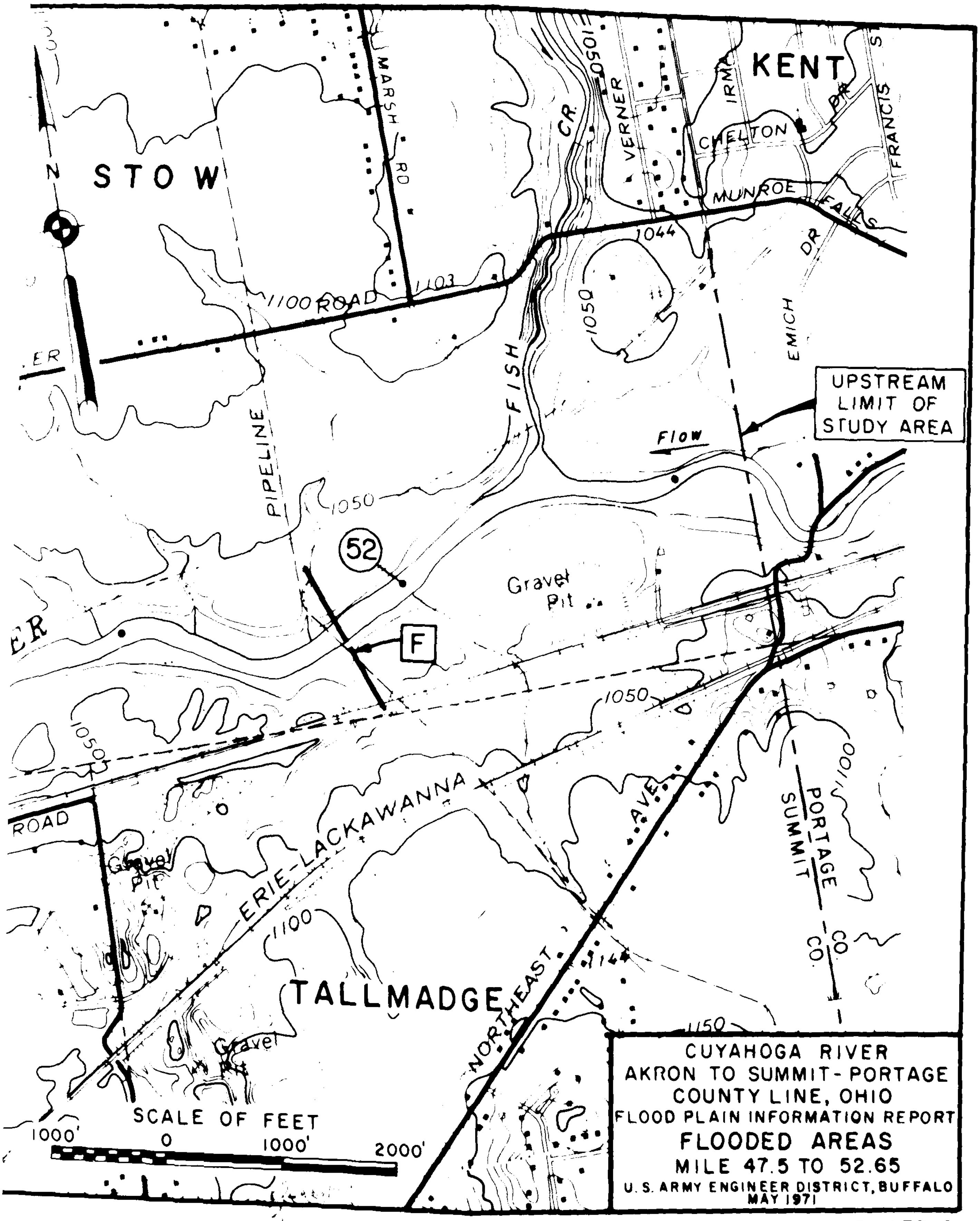

CRYSTAL LAKE
SILVER LAKE
SILVER LAKE
City Park
FRANKLIN
VINCENT RD
MILLBORO RD
OVERBROOK RD
SILVER LAKE
HASTINGS RD
LEE RD
BLVD
OUTLOOK DR
OAK PARK BLVD
CENTRAL TRANS CO.
CHARLES
KENT RD
1000
1020
1024
1044
1050
48
49
5
Flow
Waterworks Park
Waterworks
MATCH LINE B-B
CUYAHOGA FALLS CITY LIMIT
MUNROE FALLS
SILVER LAKE TWP.
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
FLOODED AREAS
MILE 44.0 TO 49.0
U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE 6


SILVER LAKE
SILVER LAKE
MATCH LINE B-B
SILVER LAKE BLVD
OVERBROOK RD
MILLBORO RD
HASTINGS RD
LEE RD
ST
CHARLES
(UNDER CONSTRUCTION)
VINCENT
CO.
TRANS.
CENTRAL
2D.
8
91
KENT RD
SILVER LAKE TWP.
Cem
1050
1020
STOW
MUNROE FALLS TWP
MUNROE
Sewage Disposal
OLD
Gravel Pit
CUYAHOGA
RAIL
49
48
OUTLOOK DR
1000
Flow
OAK PARK BLVD
OWAISA
OVERBROOK RD
Waterworks Park
AND
OHI
CUYAHOGA FALLS TWP
MUNROE FALLS
CITY TWP
RUTH AVE
BALTIMORE
D
BAILEY
PENN
CUYAHOGA FALLS
Waterworks
AVE
RD
1046
MUNROE FALLS
Gravel Pit
Schnee Sch
ST
LIMIT
PRENTISS
CENTER AVE
RD
HIGH ST
SCHUBERT ST
Price Sch
AVE
ISSAQUAM
DR
GAME
1045
1050
1081
MYRTLE
ANDERSON
ST



LEGEND:
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
48
DISTANCE FROM MOUTH IN MILES
E
LOCATION OF VALLEY CROSS SECTION
LIMITS OF OVERFLOW INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON GROUND, AS EXPLAINED IN THIS REPORT.
N
MUNROE FALLS
TALLMADGE
MAPLE RD
ECHO RD
TWP.
STOW
PINEHURST RD
LINDSEY RD
Water Tank
BERMONT AVE
DARROW RD
N RIVER
River View Sch
RAILROAD
HOGA
50
51
E
OHIO
DAM
GRADE
RIVER
SOUTH RIVER ROAD
MUNROE FALLS TWP.
PARK LAKE
County Home
91
1130
1120
1093
1126
1100
1050
1081
1079
1150
1000



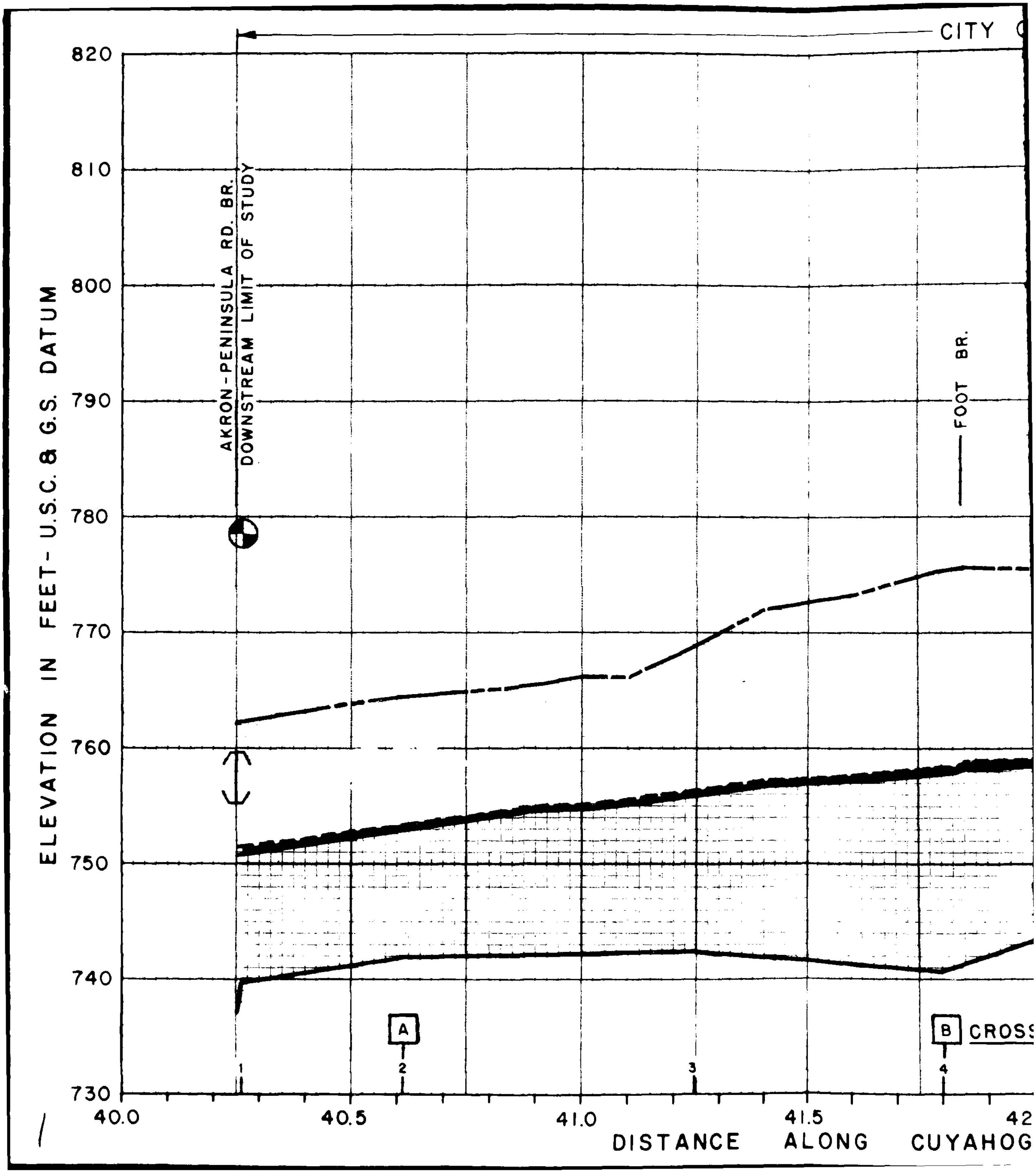
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

FLOODED AREAS

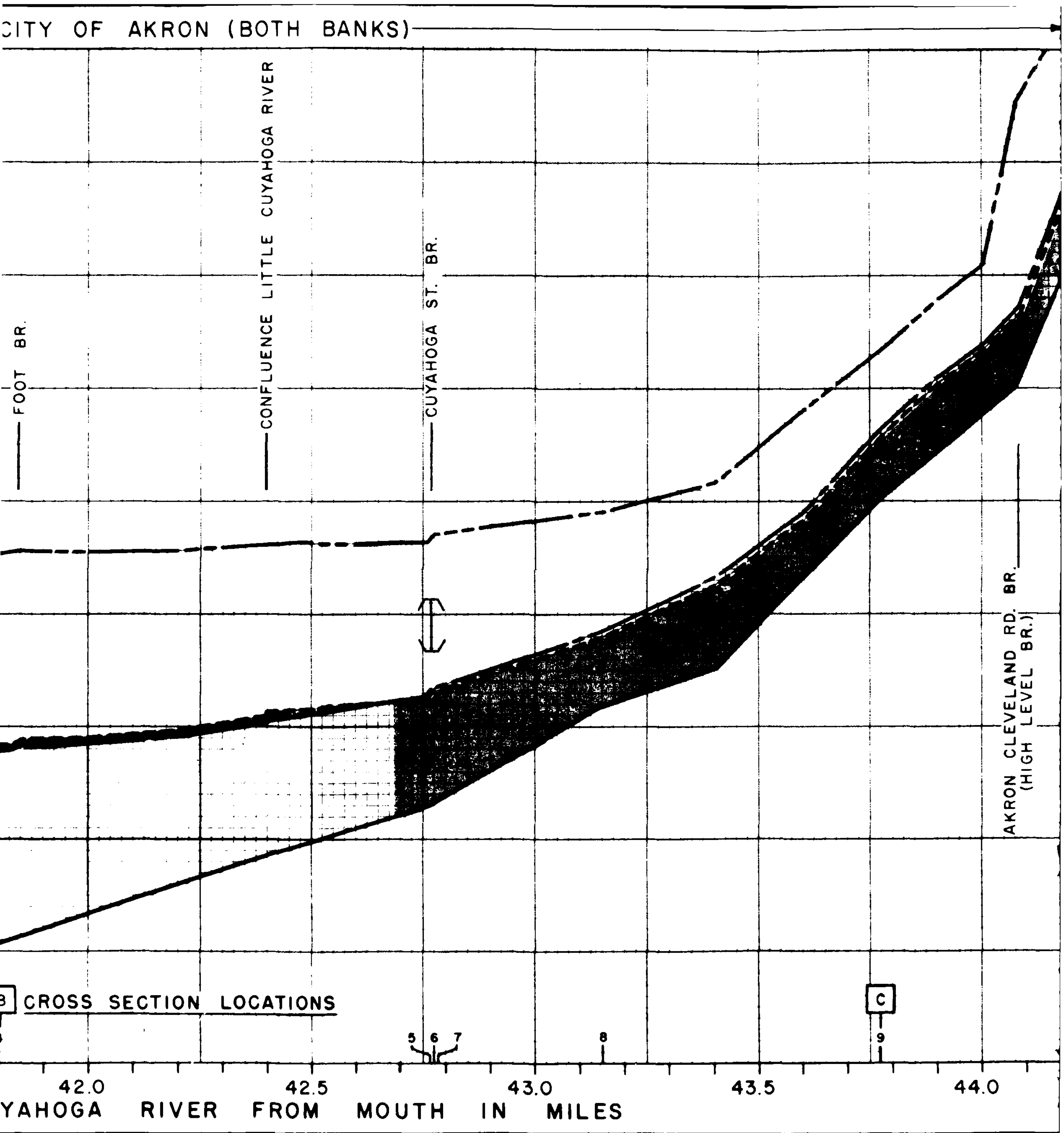
MILE 47.5 TO 52.65

U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

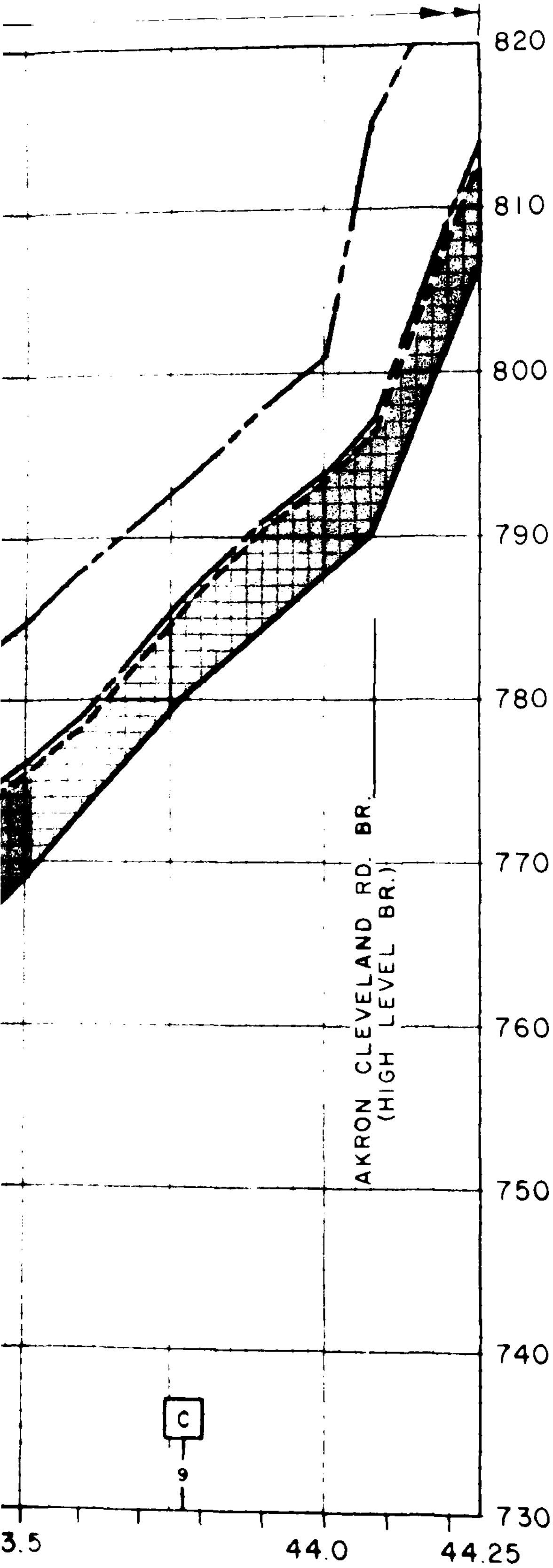
PLATE 7



CITY O
AKRON-PENINSULA RD. BR.
DOWNSTREAM LIMIT OF STUDY
FOOT BR.
ELEVATION IN FEET - U.S.C. & G.S. DATUM
820
810
800
790
780
770
760
750
740
730
A
B
CROSS
1
2
3
4
40.0
40.5
41.0
41.5
42
DISTANCE ALONG CUYAHOG



CITY OF AKRON (BOTH BANKS)
FOOT BR.
CONFLUENCE LITTLE CUYAHOGA RIVER
CUYAHOGA ST. BR.
AKRON CLEVELAND RD. BR.
(HIGH LEVEL BR.)
B
CROSS SECTION LOCATIONS
C
5
6
7
8
9
42.0
42.5
43.0
43.5
44.0
YAHOGA RIVER FROM MOUTH IN MILES



LEGEND:

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

JANUARY 1959 FLOOD

APPROXIMATE STREAM BED

APPROXIMATE FLOOR ELEVATION

APPROXIMATE LOW STEEL ELEVATION

U.S.G.S. WATER-STAGE RECORDING GAGE

A LOCATION OF VALLEY CROSS SECTION

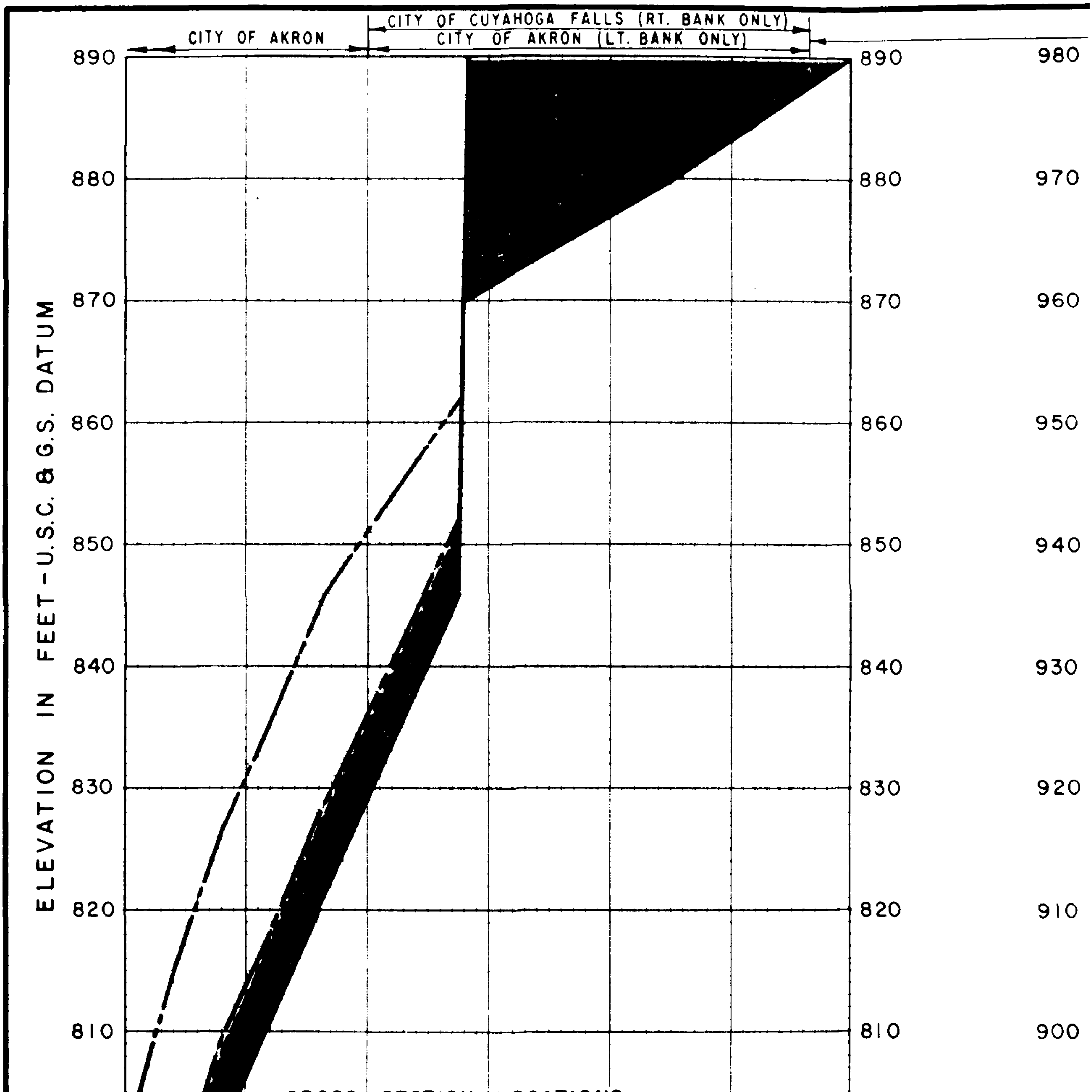
NOTES:

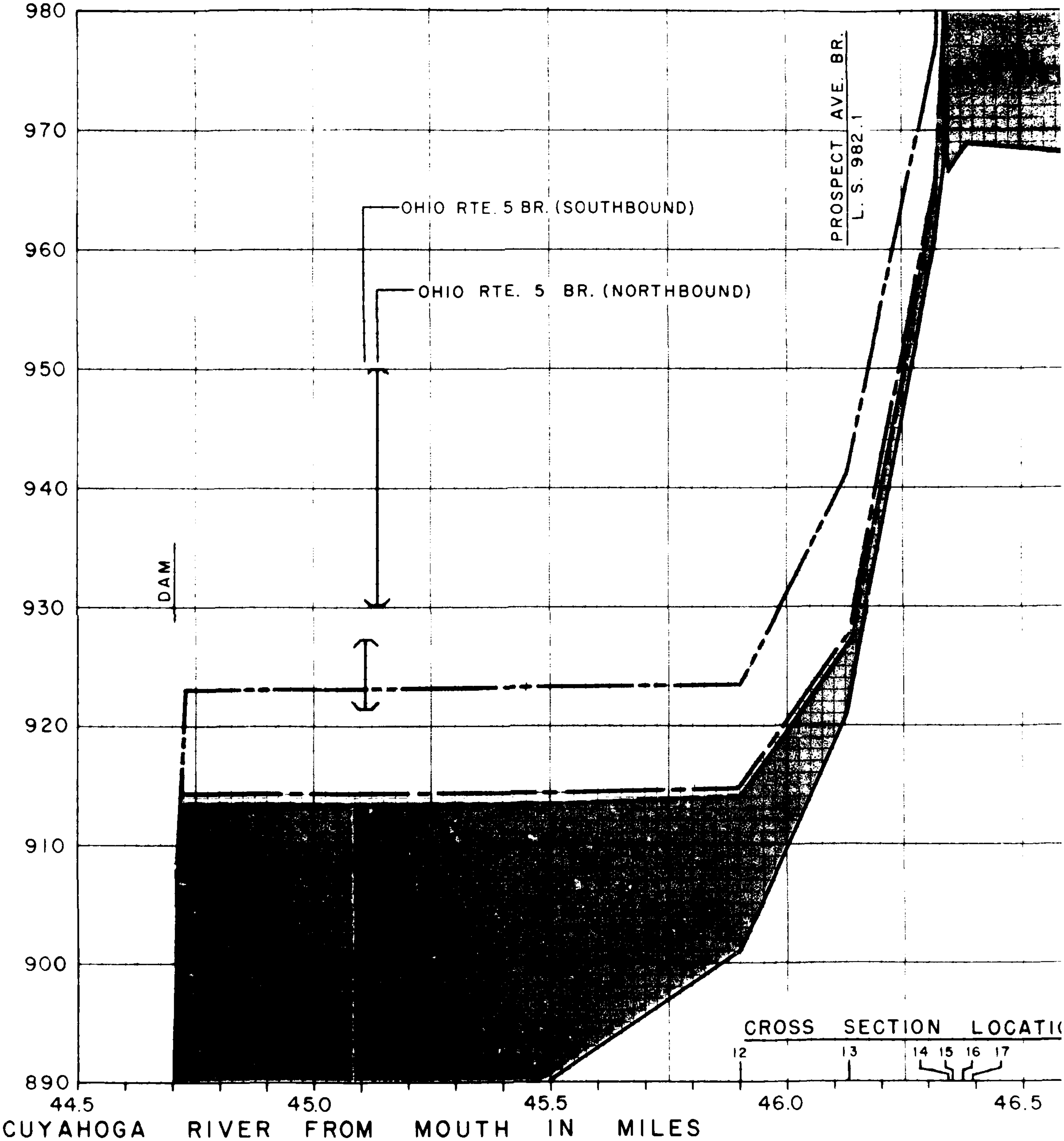
CREST PROFILES ARE BASED ON THE FOLLOWING:

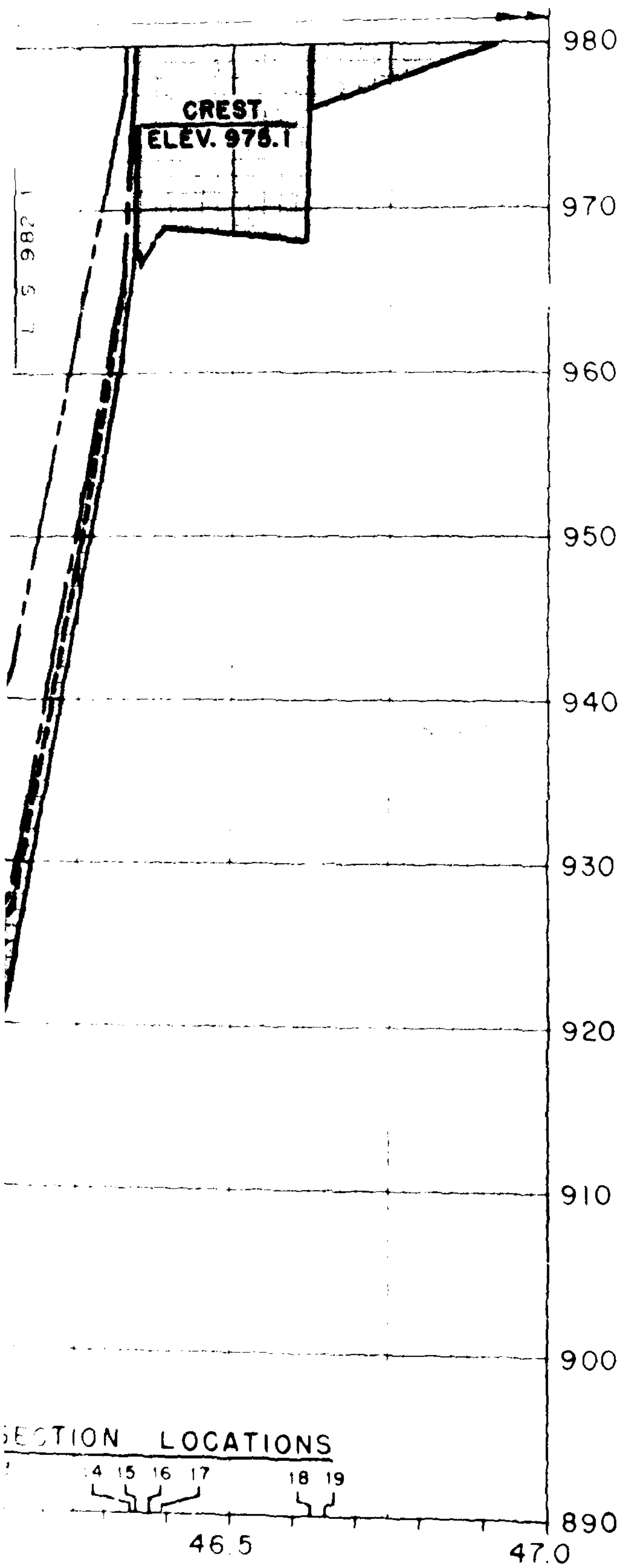
1. EXISTING CHANNEL CONDITIONS
2. EXISTING STRUCTURES
3. EXISTING CONDITIONS OF DEVELOPMENT

LARGE SCALE FILLING WILL RAISE PROFILES UNLESS SUFFICIENT FLOODWAY IS PROVIDED.

CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
PROFILES
MILE 40.25 TO 44.25
U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971


CITY OF CUYAHOGA FALLS (RT. BANK ONLY)
CITY OF AKRON
CITY OF AKRON (LT. BANK ONLY)
ELEVATION IN FEET - U.S.C. & G.S. DATUM
890
880
870
860
850
840
830
820
810
800
980
970
960
950
940
930
920
910
900
890
CROSS SECTION LOCATIONS
10 11
44.0
44.5
45.0
45.5
44
DISTANCE ALONG CUYA


980
970
960
950
940
930
920
910
900
890
PROSPECT AVE. BR.
L. S. 982.1
OHIO RTE. 5 BR. (SOUTHBOUND)
OHIO RTE. 5 BR. (NORTHBOUND)
DAM
CROSS SECTION LOCATI
12
13
14 15 16 17
44.5
45.0
45.5
46.0
46.5
CUYAHOGA RIVER FROM MOUTH IN MILES



LEGEND:

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

JANUARY 1959 FLOOD

APPROXIMATE STREAM BED

APPROXIMATE FLOOR ELEVATION

APPROXIMATE LOW STEEL ELEVATION

NOTES:

CREST PROFILES ARE BASED ON THE FOLLOWING:

1. EXISTING CHANNEL CONDITIONS
2. EXISTING STRUCTURES
3. EXISTING CONDITIONS OF DEVELOPMENT

LARGE SCALE FILLING WILL RAISE PROFILES UNLESS SUFFICIENT FLOODWAY IS PROVIDED.

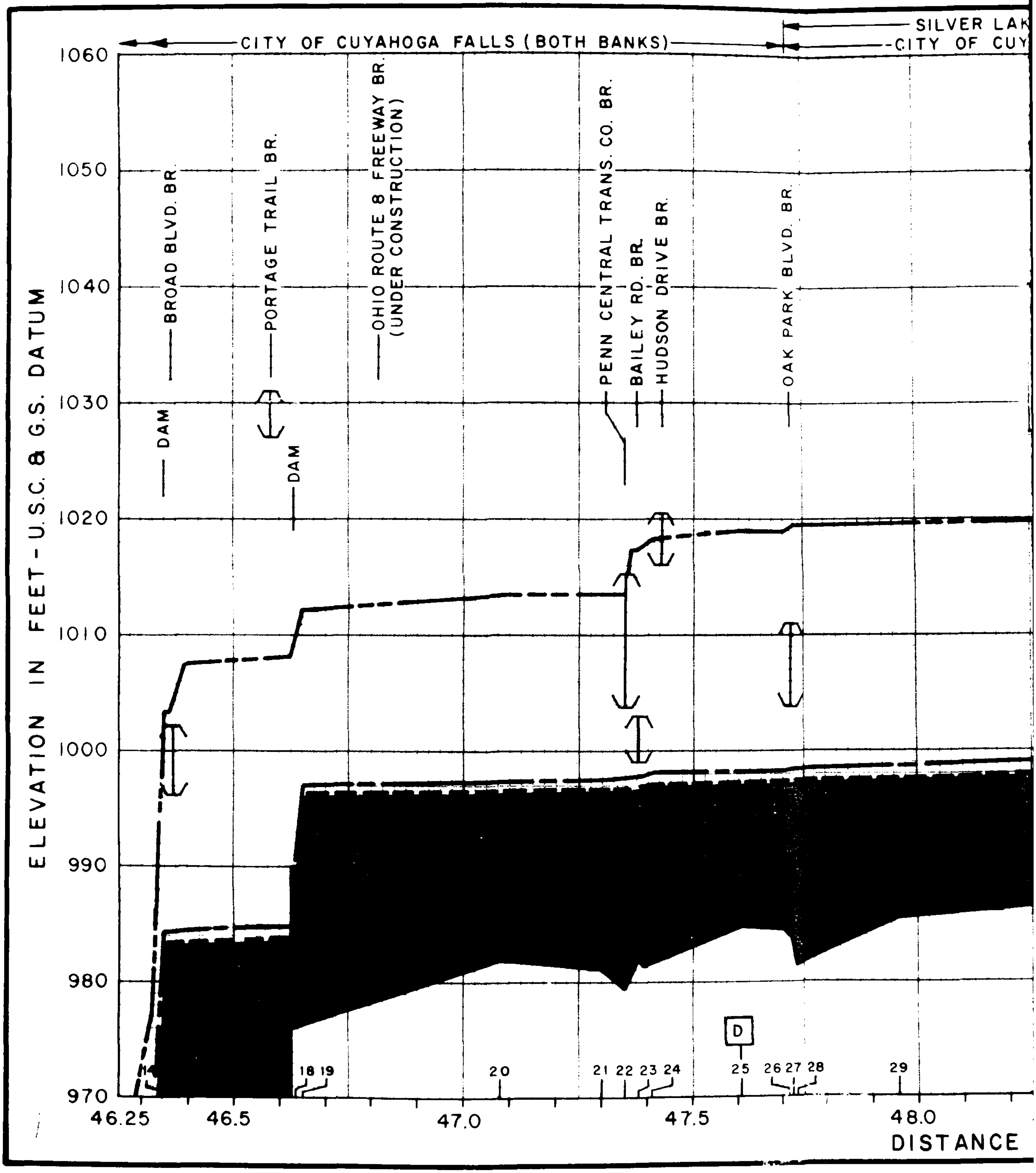
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

PROFILES

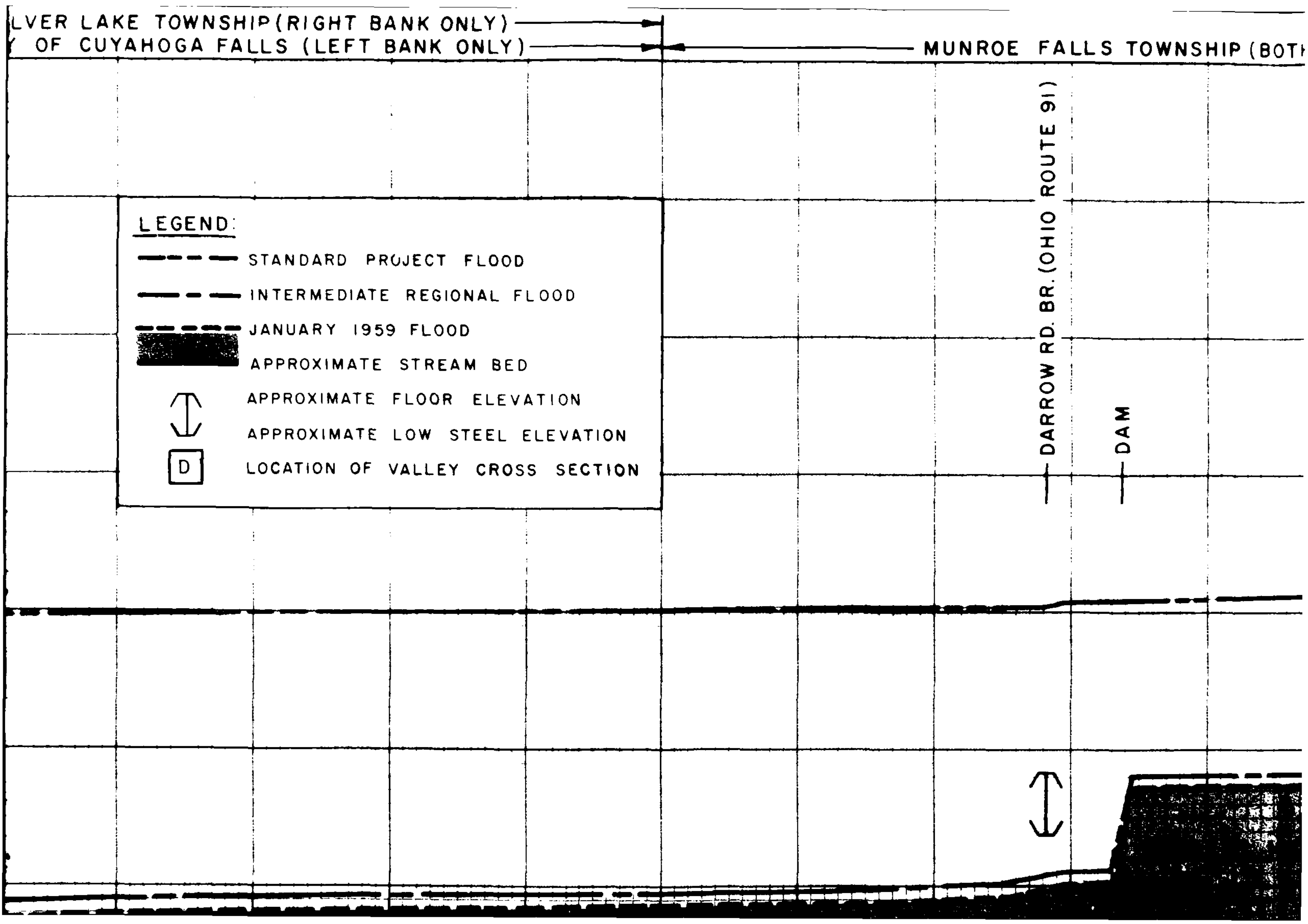
MILE 44.0 TO 47.0

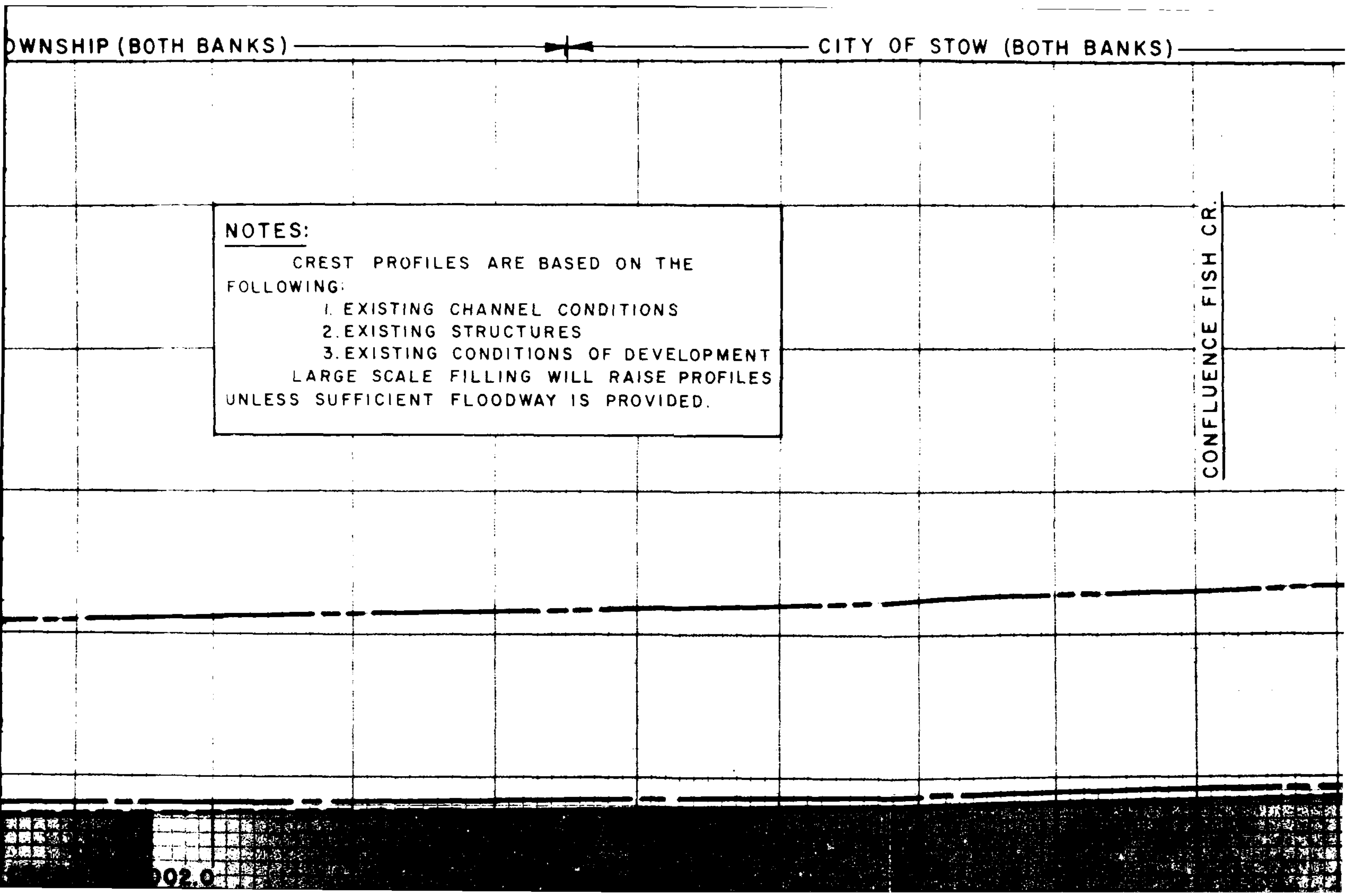
U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE 9

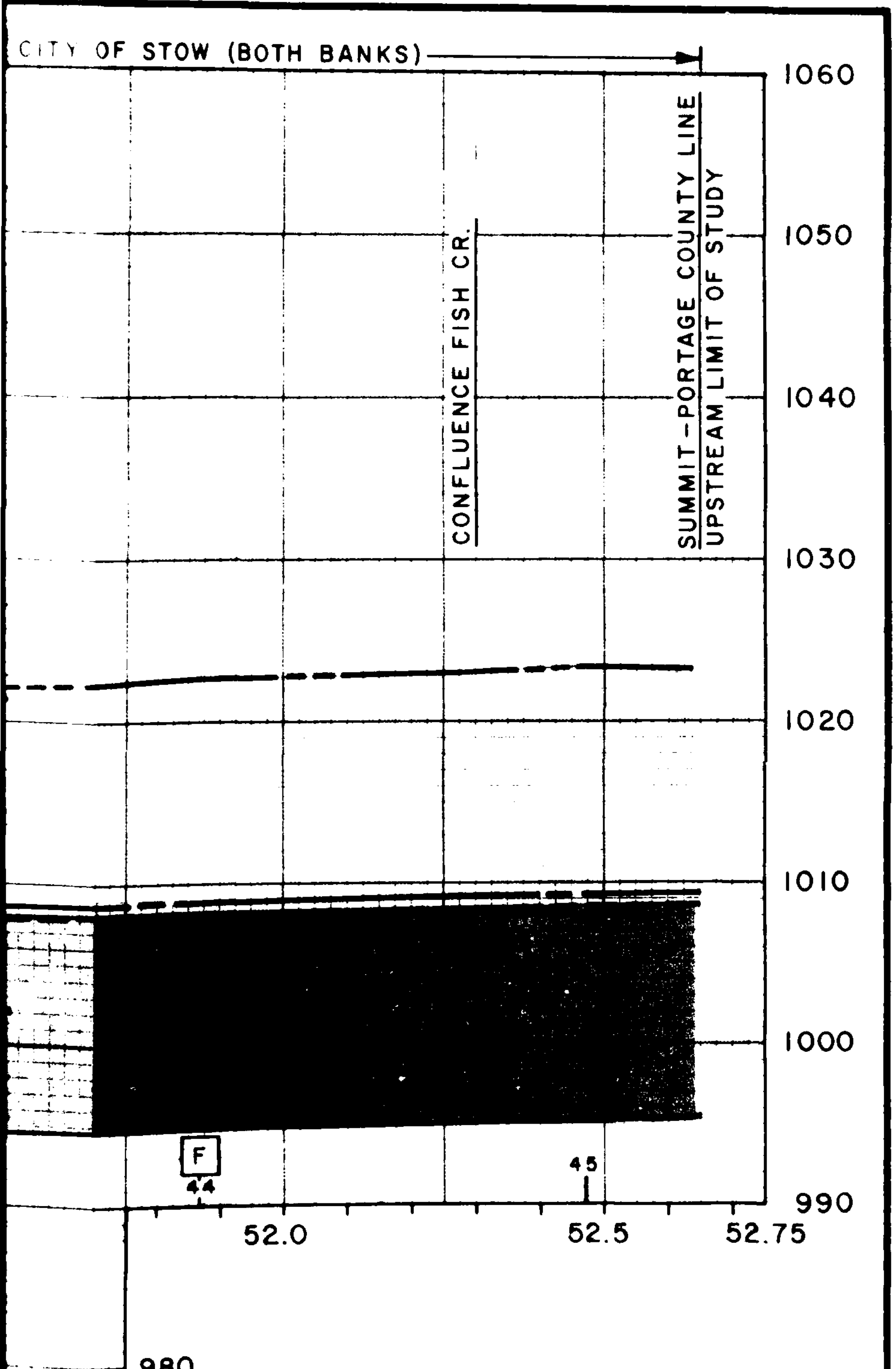


SILVER LAK
CITY OF CUYAHOGA FALLS (BOTH BANKS)
CITY OF CUY
ELEVATION IN FEET - U.S.C. & G.S. DATUM
1060
1050
1040
1030
1020
1010
1000
990
980
970
BROAD BLVD. BR.
DAM
PORTAGE TRAIL BR.
DAM
OHIO ROUTE 8 FREEWAY BR.
(UNDER CONSTRUCTION)
PENN CENTRAL TRANS. CO. BR.
BAILEY RD. BR.
HUDSON DRIVE BR.
OAK PARK BLVD. BR.
D
14
18 19
20
21 22 23 24
25
26 27 28
29
46.25
46.5
47.0
47.5
48.0
DISTANCE


LVER LAKE TOWNSHIP (RIGHT BANK ONLY)
Y OF CUYAHOGA FALLS (LEFT BANK ONLY)
MUNROE FALLS TOWNSHIP (BOT
LEGEND:
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
JANUARY 1959 FLOOD
APPROXIMATE STREAM BED
APPROXIMATE FLOOR ELEVATION
APPROXIMATE LOW STEEL ELEVATION
D
LOCATION OF VALLEY CROSS SECTION
DARROW RD. BR. (OHIO ROUTE 91)
DAM



WNSHIP (BOTH BANKS)
CITY OF STOW (BOTH BANKS)
NOTES:
CREST PROFILES ARE BASED ON THE FOLLOWING:
1. EXISTING CHANNEL CONDITIONS
2. EXISTING STRUCTURES
3. EXISTING CONDITIONS OF DEVELOPMENT
LARGE SCALE FILLING WILL RAISE PROFILES UNLESS SUFFICIENT FLOODWAY IS PROVIDED.
CONFLUENCE FISH CR.

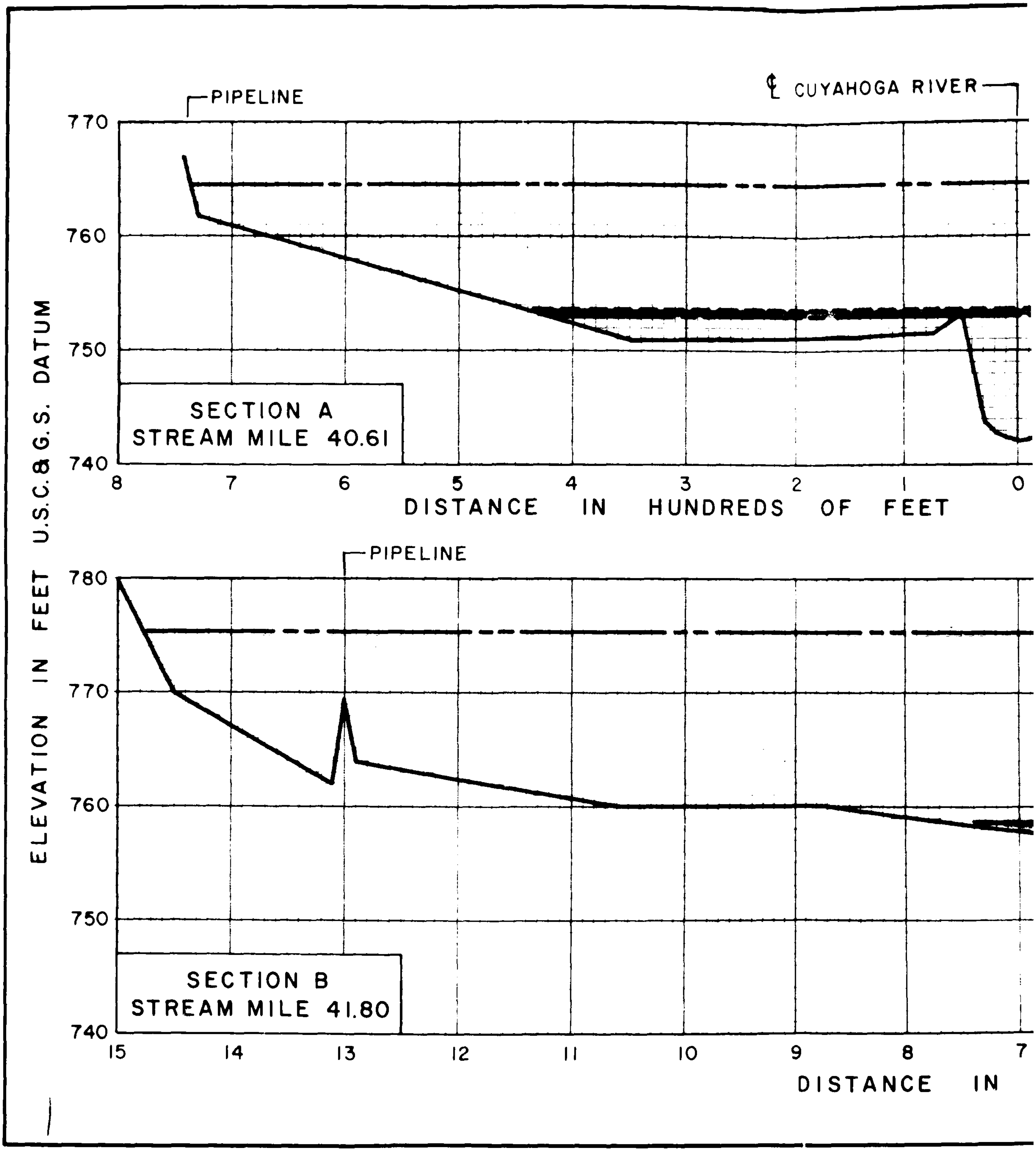


CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

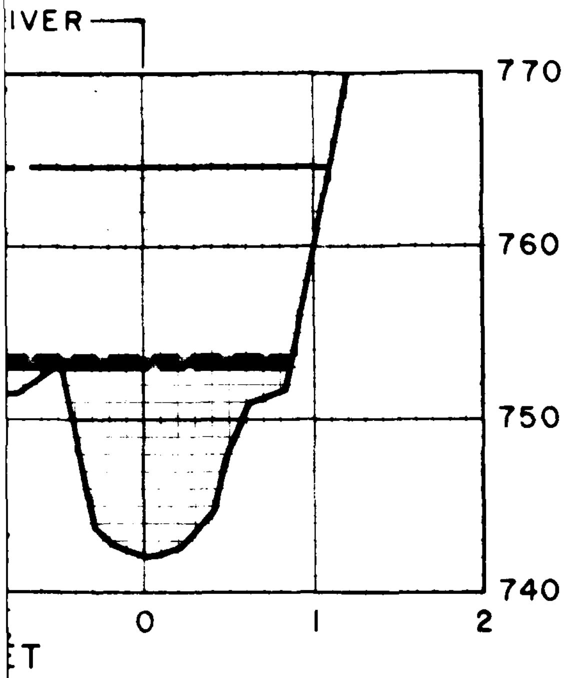
PROFILES

MILE 46.25 TO 52.65

U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971



PIPELINE
℄ CUYAHOGA RIVER
770
760
750
740
SECTION A
STREAM MILE 40.61
8
7
6
5
4
3
2
1
0
DISTANCE IN HUNDREDS OF FEET
PIPELINE
780
770
760
750
740
SECTION B
STREAM MILE 41.80
15
14
13
12
11
10
9
8
7
DISTANCE IN
ELEVATION IN FEET U.S.C.&G.S. DATUM

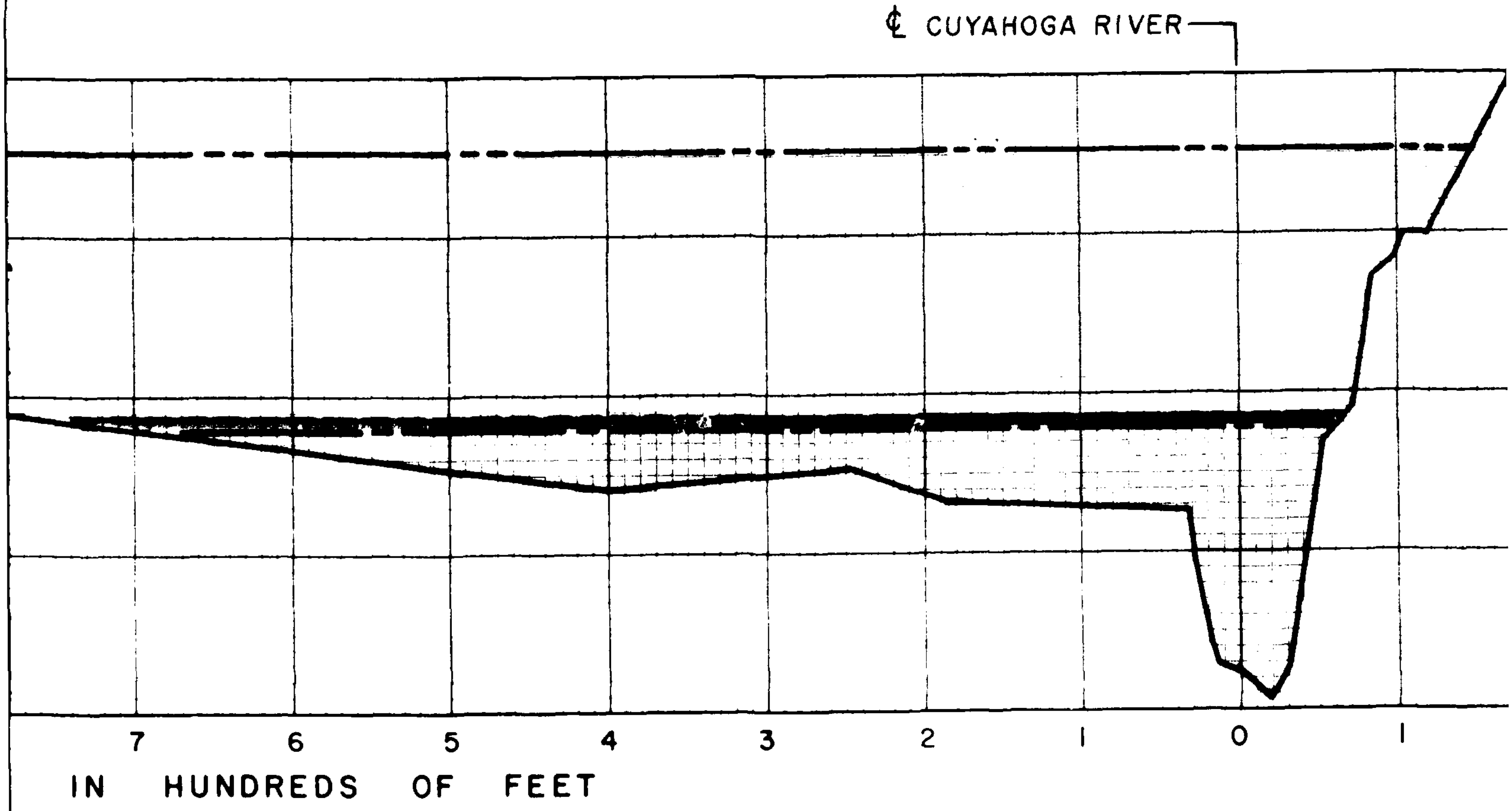


LEGEND:

- STANDARD PROJECT FLOOD
- JANUARY 1959 FLOOD
- INTERMEDIATE REGIONAL FLOOD
- APPROXIMATE GROUND SURFACE

NOTE

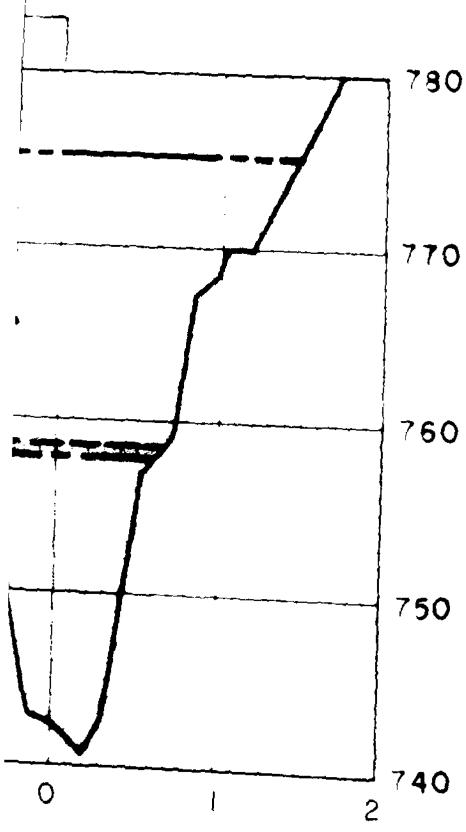
VA
FIELD
VA
AND A



NOTES

VALLEY CROSS SECTIONS ARE BASED ON ACTUAL FIELD SURVEYS AND U.S. GEOLOGICAL QUADRANGLE MAPS

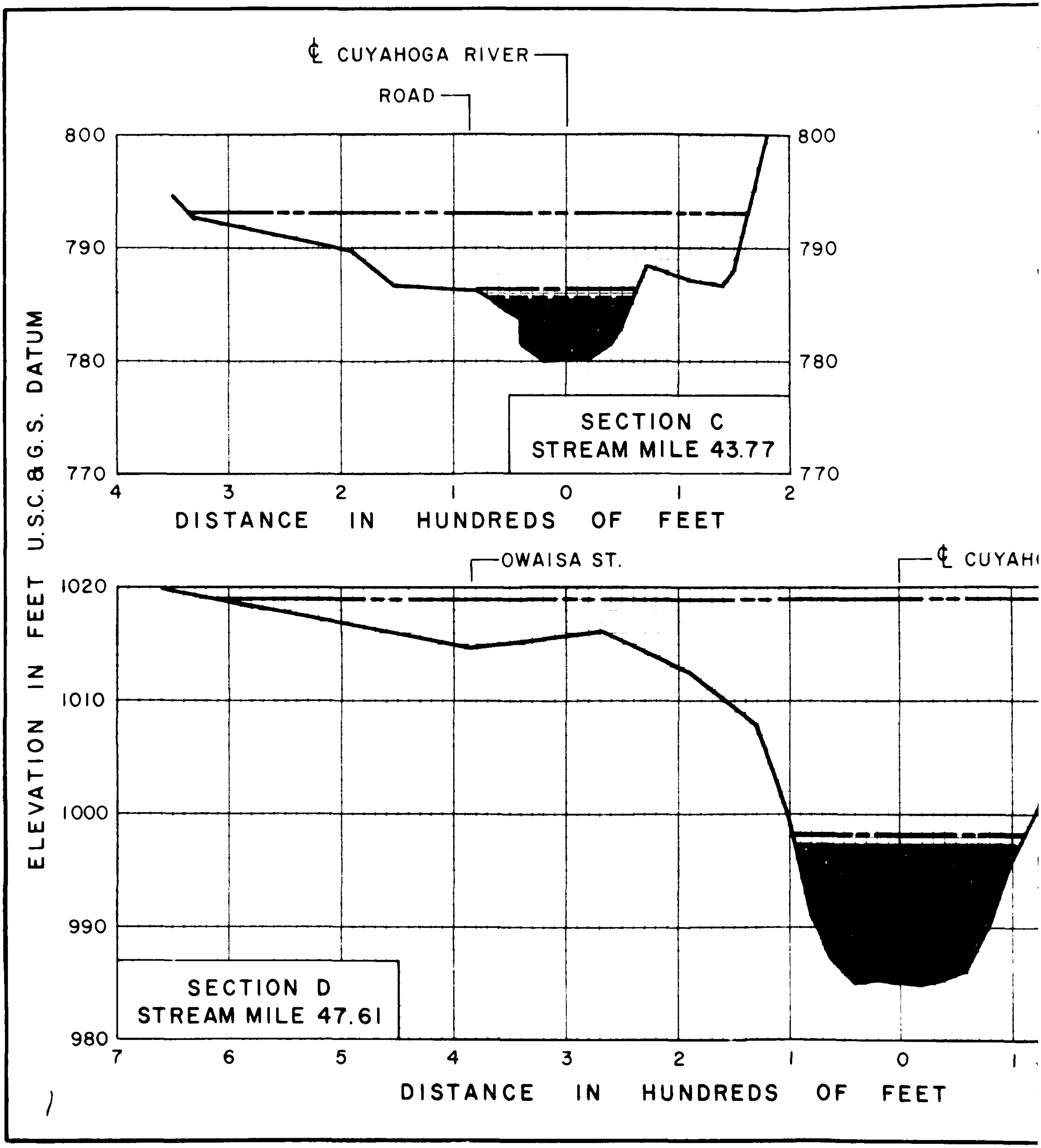
VALLEY CROSS SECTIONS ARE LOOKING DOWNSTREAM AND ARE LOCATED ON PLATE 5



CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
VALLEY CROSS SECTIONS
A AND B
U.S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

3

PLATE II



℄ CUYAHOGA RIVER
ROAD
800
790
780
770
800
790
780
770
SECTION C
STREAM MILE 43.77
4
3
2
1
0
1
2
DISTANCE IN HUNDREDS OF FEET
ELEVATION IN FEET U.S.C.&G.S. DATUM
OWAISA ST.
℄ CUYAH
1020
1010
1000
990
980
SECTION D
STREAM MILE 47.61
7
6
5
4
3
2
1
0
1
DISTANCE IN HUNDREDS OF FEET

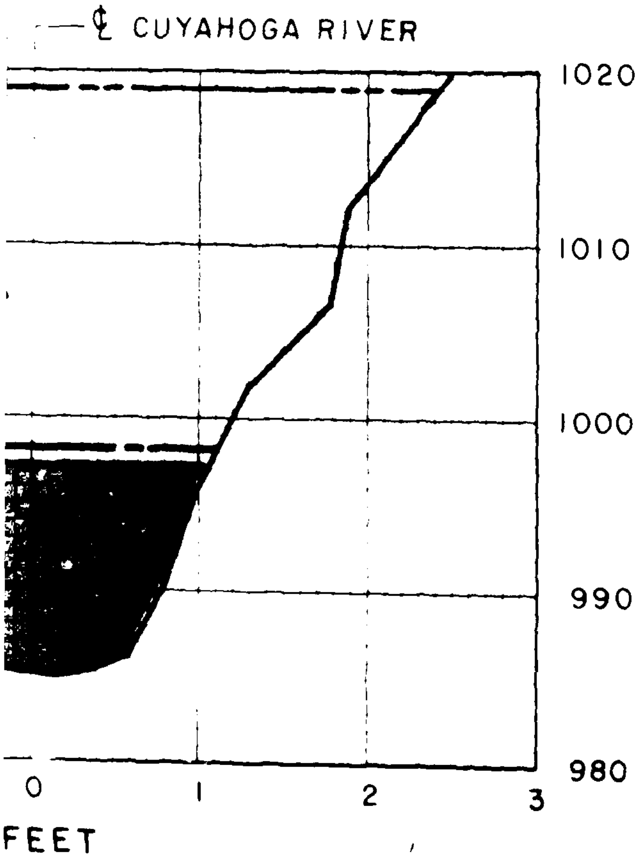
LEGEND:

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

JANUARY 1959 FLOOD

APPROXIMATE GROUND SURFACE



NOTES:

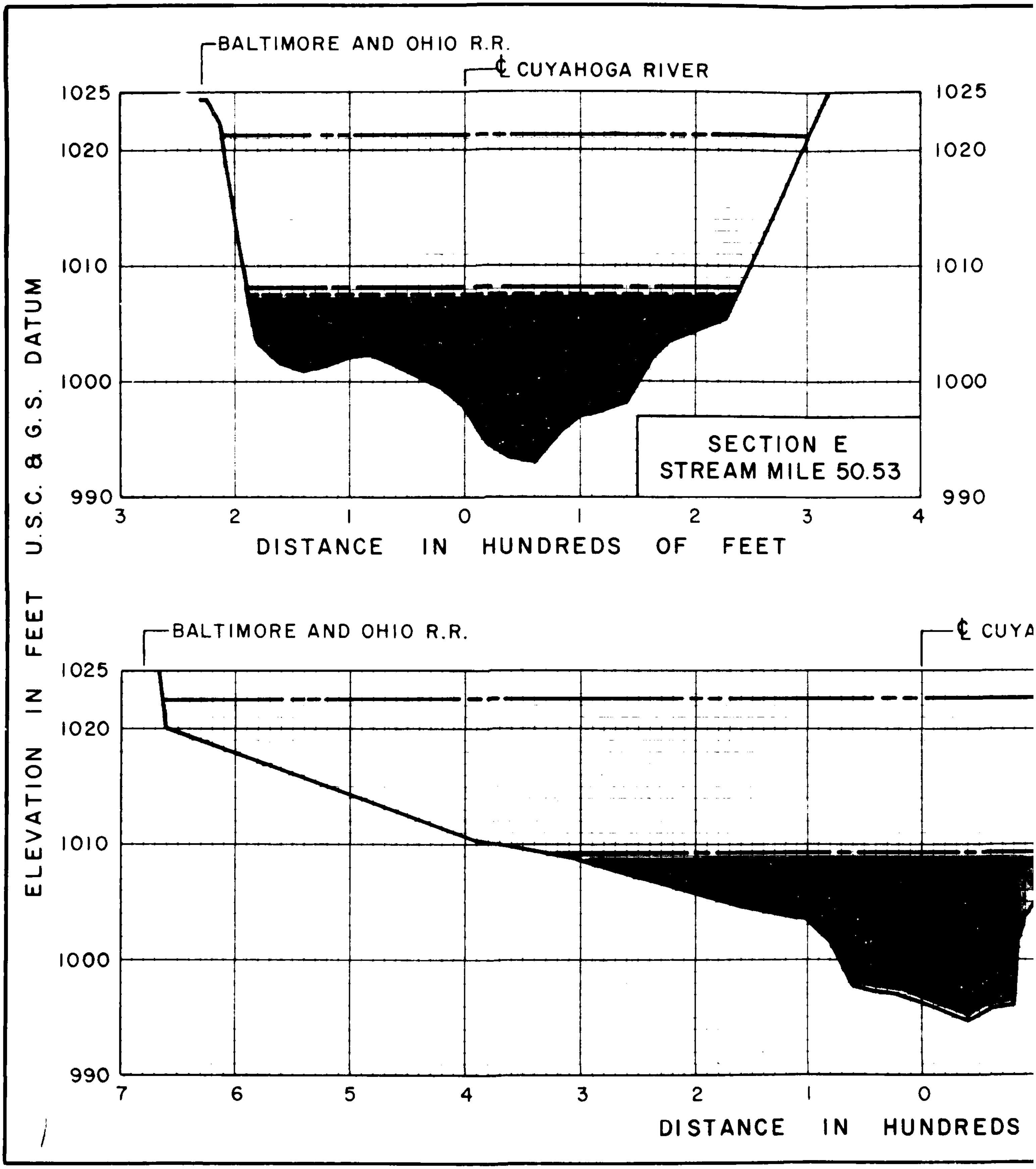
VALLEY CROSS SECTIONS ARE BASED ON ACTUAL ~~ACTIONAL~~ FIELD SURVEYS AND U S GEOLOGICAL QUADRANGLE MAPS.

VALLEY CROSS SECTIONS ARE LOOKING DOWNSTREAM AND ARE LOCATED ON PLATES 5 AND 6.

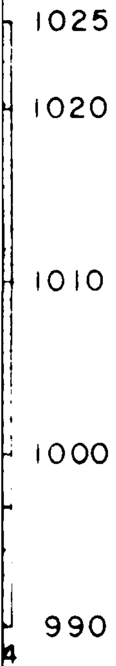
CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT

VALLEY CROSS SECTIONS C AND D

U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971



BALTIMORE AND OHIO R.R.
℄ CUYAHOGA RIVER
1025
1020
1010
1000
990
SECTION E
STREAM MILE 50.53
3
2
1
0
1
2
3
4
DISTANCE IN HUNDREDS OF FEET
ELEVATION IN FEET U.S.C. & G.S. DATUM
BALTIMORE AND OHIO R.R.
℄ CUYA
1025
1020
1010
1000
990
7
6
5
4
3
2
1
0
DISTANCE IN HUNDREDS



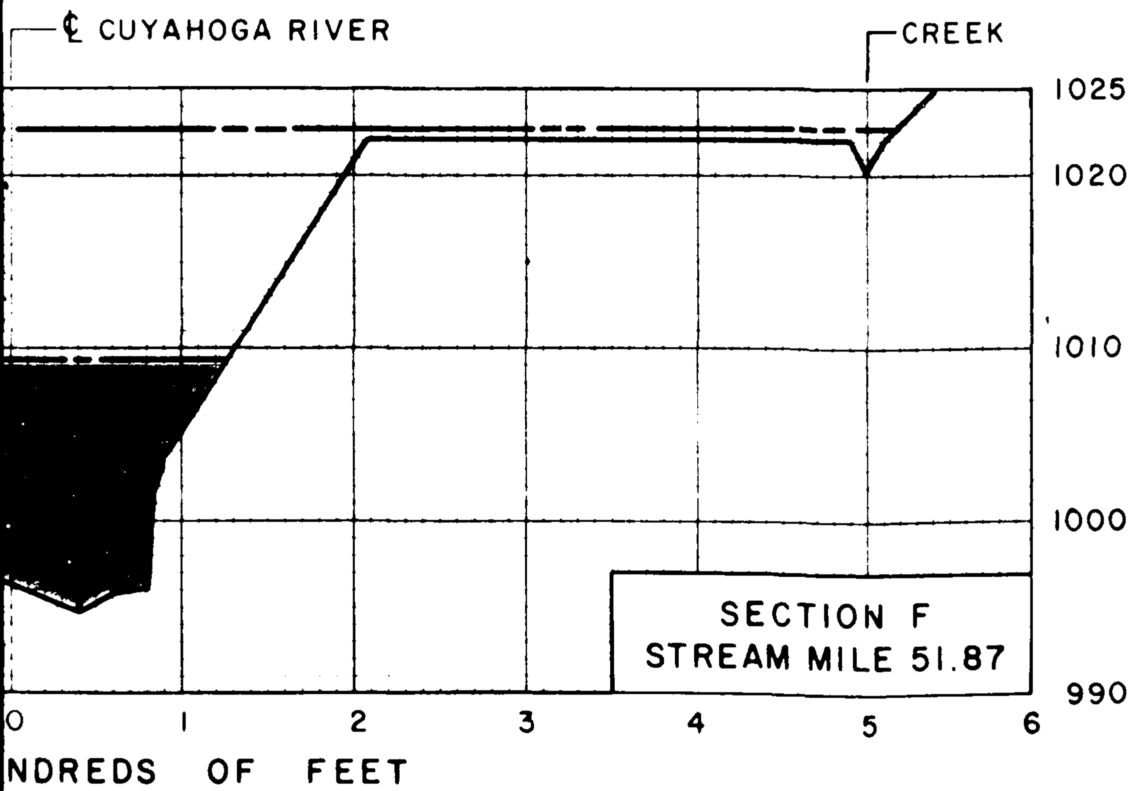
LEGEND:

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL F

JANUARY 1959 FLOOD

APPROXIMATE GROUND SUF



NOTES:

VALLEY CROSS SECTIONS ARE E ACTUAL ~~ACTIONAL~~ FIELD SURVEYS AND U. S. GE QUADRANGLE MAPS.

VALLEY CROSS SECTIONS ARE DOWNSTREAM AND ARE LOCATED ON

CUYAHOGA
AKRON TO SUMM
COUNTY LIN
FLOOD PLAIN INFORM
VALLEY CROSS
E AND
U. S. ARMY ENGINEER DIS
MAY 197

LEGEND:

- — — — — STANDARD PROJECT FLOOD
- —— — —— INTERMEDIATE REGIONAL FLOOD
- JANUARY 1959 FLOOD
- APPROXIMATE GROUND SURFACE

NOTES:

VALLEY CROSS SECTIONS ARE BASED ON ACTUAL ~~NOTIONAL~~ FIELD SURVEYS AND U. S. GEOLOGICAL QUADRANGLE MAPS.

VALLEY CROSS SECTIONS ARE LOOKING DOWNSTREAM AND ARE LOCATED ON PLATE 7.

1025

1020

1010

1000

990

6

CUYAHOGA RIVER
AKRON TO SUMMIT-PORTAGE
COUNTY LINE, OHIO
FLOOD PLAIN INFORMATION REPORT
VALLEY CROSS SECTIONS
E AND F
U. S. ARMY ENGINEER DISTRICT, BUFFALO
MAY 1971

PLATE 13

END

DATE
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